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Development of National Water-Power Resources—Part II.

Comprehensive Discussion and Compilation of Data Presented in Report of the Water-Power Development Committee of the National Electric Light Association at Its Recent Convention

The power consumed in various sections of the country makes interesting comparisons. It may be noted that the western states have the highest per capita consumption and the lowest rates of any due to the available water power.

Comparing the uses of electricity in the West it is thus to be seen that the per capita use of electricity in the far western states is 2.21 times that of the remainder of the nation. Again it is interesting to note that while distances are vast, the development of long-distance hydroelectric transmission has made possible electric power rates that are extremely low, averaging 1.66 cents per kw-hr., as compared to 2.19 cents per kw-hr. obtaining elsewhere in the country. In spite of these low rates the income to the power company per capita is almost twice that east of the Rockies.

Figures made public on April 8, 1920, by the Department of the Interior give some startling comparisons:

JANUARY, 1920, OUTPUTS.

Nine western states.. 477,833,000-kw-hr. by water power
All other states..... 796,568,000-kw-hr. by water power
Nine western states.. 161,214,000-kw-hr. by fuels
All other states.....2,418,984,000-kw-hr. by fuels
Nine western states.. 639,047,000-kw-hr. total
All other states.....3,215,552,000-kw-hr. total

PER CAPITA CONSUMPTION.

Nine western states..54.8-kw-hr. per capita from water power
All other states.....8.12-kw-hr. per capita from water power
Nine western states..18.5-kw-hr. per capita from fuels
All other states.....24.6-kw-hr. per capita from fuels
Nine western states..73.3-kw-hr. per capita total
All other states.....32.7-kw-hr. per capita total

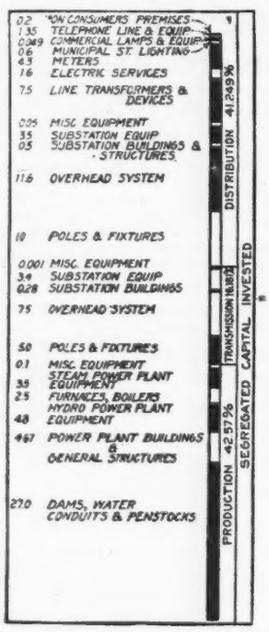
This table shows that the per capita consumption in the western states, of energy produced by water power, is 6.75 times that consumed in all the other states. The per capita consumption of power from both fuel and water power in the

Hundreds of Water-Power Developments Like the Above Could Be Utilized if Financing and Proper Legislation Were Forthcoming.

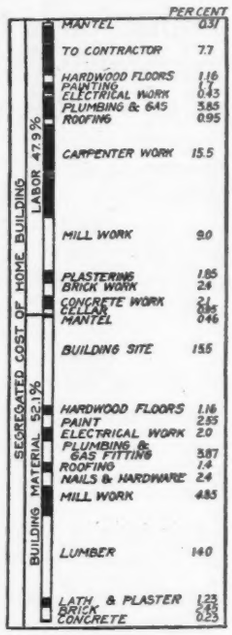
western states is 2.24 times that of the other states. This consumption of water-power energy is particularly striking in that it is the result obtained in a dry year, as under conditions of normal rainfall the production of a large part of the energy now produced by fuel would have been supplanted by water power and given a still higher ratio between the per capita consumption in the West as against the East.

Distribution of Potential Water Power.

Of the total potential water power of the United States, the state of Washington stands first with 9,500,000 hp., or 15%. California is second with 9,250,000 hp., or 14.6%, and Oregon ranks third with 7,000,000 hp., or 11%. These



Segregated Investment of Capital for Electric Power Development.



Segregated Costs of Home Building Compiled from Builders' Records.

three Pacific Coast states together represent 40.6% of the total potential maximum water power of the United States. Including the states of Idaho and Montana, these five typically western states represent 57.1% of the total potential maximum water power of the United States, with a total of 35,750,000 hp. These figures all clearly emphasize that the problem of future water-power development is quite distinctly a western problem, and this is stated without detracting in any way from the wonderful developments which have already been accomplished in the East.

In the eastern states some large developments are contemplated on navigable streams. Over 1,000,000 hp. is contemplated in the states of Alabama, North Carolina, Georgia and Maryland. At some future time it is to be expected also that economic conditions will force the further development of Niagara Falls, of which approximately 75% remains still undeveloped. Increased efficiency of existing plants through interconnection of plants and development of storage facilities is to be expected in the near future.

The electrification of the trunk line railroads of the western section of the United States will require the development of a portion of the water powers of that territory. In the carrying out of this electrification, transmission lines will of necessity run along the railway lines and pass through the centers of population adjacent thereto. These lines should thus readily become the interconnecting links between local networks. The railway electrification, therefore, in addition to creating a new market for electric power, will be an agent in the creation of a large network.

Future Growth to Be Anticipated in Power Development.

In order to get accurate data on power possibilities, or, rather, power to be anticipated during the next decade, a questionnaire was sent out to all the 52 power companies in the far western states, calling for a statement of their loads during the past ten years, and also their estimated loads up to and including 1928. Superimposing these various load charts, one upon the other, conclusions were reached that during the next ten years the expected development of power in the West will rise to the vast total of 1,776,260 kw. At present-day prices the investment capacity at power plants is running in the neighborhood of $200 per kilowatt. The transmission, transformation and distribution expense and incidentals involved in properly marketing the product will entail an additional expenditure of some $200 per kilowatt.

Thus it is readily seen that something like $710,510,000 must be expended in the West before 1929 to meet the situation. While this vast amount of capital is necessary as a prime source of development, it is easily seen that such development will carry along with it an equal call for electrical installation in appliances in the home, upon the farm, and in industry, that may well total an equivalent amount. The most concern is with the question of the original amount, for with that secured the remainder finances itself. Indeed, so important, not only to the continued prosperity of the power companies involved, but to the nation itself, both East and West, is the problem of water-power development that it is not overemphasizing the matter to state that the most vital question is the securing of that $710,510,000, as well as the millions needed for developments east of the Rockies—in short, the question of financing.

Water-Power Development Essential to Western Growth.

Recent interest in the West has been focused on what has become known as the "self-interest" appeal. From a well-known power company the following data have been supplied as taken from the records required by the regulatory body of the state wherein the power company operates, in which capital in former years for power development was distributed as shown in the accompanying chart.

Examining the details of this chart, it may be predicted to what extent various subdivisions of industry will be interested in the investment of this $710,510,000. Thus the transformer manufacturer knows that 7½%, or $53,000,000, of this money will be expended for transformers. To the man in the street, too, the problem is of

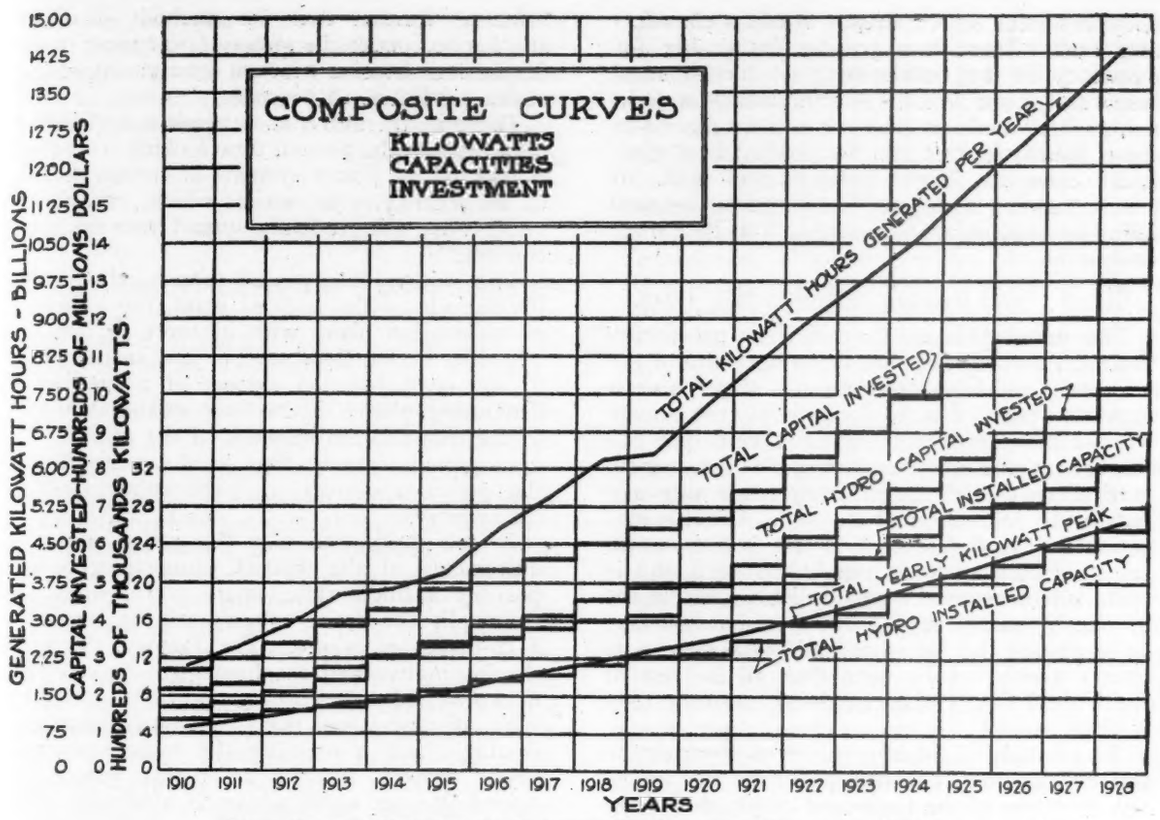

COMPOSITE CURVES
KILOWATTS
CAPACITIES
INVESTMENT
TOTAL KILOWATT HOURS GENERATED PER YEAR
TOTAL CAPITAL INVESTED
TOTAL HYDRO CAPITAL INVESTED
TOTAL INSTALLED CAPACITY
TOTAL YEARLY KILOWATT PEAK
TOTAL HYDRO INSTALLED CAPACITY
GENERATED KILOWATT HOURS - BILLIONS
CAPITAL INVESTED-HUNDREDS OF MILLIONS DOLLARS
HUNDREDS OF THOUSANDS KILOWATTS
YEARS
1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928

Chart Showing Statistics for 52 Central-Station Companies in the West.

It should be noted that the kilowatt peaks are only slightly greater than the total water-power capacity installed, indicating that little fuel will be burned. The curve of total hydro capital is based on an investment in power plants, transmission lines and distribution systems of $400 per kilowatt of installed capacity. The curve of total capital is based on a total of $400 per kilowatt of both hydro and steam capacity.

unique interest and may be made to appeal to him personally. For instance, in the district surrounding Fresno, Cal., 2000 applicants for power for farm development cannot at the present time be connected upon the power lines, due to insufficient power installation. In former years it has been found that in that district for every farm delayed in development in the country two homes in the city are delayed in construction. Investigation shows that the average home in and about that vicinity has a value of some $5000. Thus it is seen that $10,000,000 in construction is delayed at the present time in that one community, due to the inability of the power companies to furnish this power. The accompanying tabulation, taken from builders' records, represents the various channels wherein money for construction and building purposes in the city is disbursed in that particular section.

Even a casual survey of this chart brings to light the fact that every form of labor and industry is vitally affected when stagnation in the power industry occurs. While conditions in other sections of the country may vary in detail from this, it is everywhere demonstrable that local stagnation follows a failure of electric generation to keep pace with the building of the empire it serves. With the tremendous growth of the West—in California alone applications for water to irrigate an additional acreage equal to 50% of the total already under cultivation have been filed in the last six months—combined with the high price and diminishing supply of fuel, it is obvious that for this region it means that the development of the country is dependent on hydroelectric development—dependent, in other words, on the financing of the construction planned.

A like evidence of the dependence of western growth upon electricity and also of the certainty of a tremendously growing demand in the future is the survey of western industries. In the intermountain region, where mining and agriculture share the prosperity of the country, both are largely dependent upon electricity. Such examples as the vast electric pumping irrigation project at Minidoka, Idaho, and the electrified mines of Montana, Idaho and Utah largely account for the high per capita use of this district. In the Northwest, paper mills find the electric drive indispensable, and even in the lumber industry first experiments in electric logging have shown electricity to be more economical than previous methods, and the electrification of sawmills is becoming quite general.

Large quantities of copper, lead and zinc are mined and smelted in the western states. These are shipped to eastern refineries. Due to the increasing cost of power in the East and the fact that these refineries must compete with industries in which the cost of power is a smaller item of the total cost of production, an enlargement of the existing refineries may be expected and the installation of additional refineries in the West in the near future. The electrolytic zinc plant now located at Great Falls is the largest in the world and has a daily capacity of 150 tons of the highest grade of zinc.

An increased consumption of power in electric furnaces may be expected for the production of

alloy and steel, which already forms a considerable load. There is a possible future use for electricity in the development of the chemical resources of the West. Advancements in technology have made possible the use of reagents in these industries that can be produced by electrical energy. These developments will, of course, require co-ordination of certain chemical industries and close co-operation with the power companies.

Present and Future Agricultural Load.

The primary basis for western prosperity, however, undoubtedly lies in its agricultural development and here electricity has played a most important part. Due to the general arid climate with an absence of summer rains which prevails throughout the greater portion of the region, particularly the Southwest, irrigation is an essential to the cultivation of the soil. Gravity irrigation is, of course, used to the fullest extent, but it is inadequate to supply the need and is being supplemented in steadily increasing degree by electric pumping. To this consideration may be attributed the fact that California uses more electric power on the farm than all the rest of the United States, the remaining western states ranking second.

An example of the importance of electricity to this development is to be seen in the rice industry, now one of the important crops of California, which depends almost entirely on electric pumping for its existence. This industry was not started until 1912, but a $27,000,000 crop was shipped from the state in 1919 and the only bar to a 25% greater acreage in 1920 is the shortage of electric power, a striking example of the dependence of agricultural growth upon hydroelectric development.

There are, in addition, various important but nevertheless minor industries in the region, listed in the census reports as 7% of the manufacturing activity of the United States, all of which are to a great extent users of electrictiy. It should be pointed out, however, in favor of the stability of western power demands, as well as the importance of electrical development to western growth, that the major industries already mentioned are essentially dependent upon electricity, whereas in the average manufacturing interest it is a factor of smaller relative importance. Thus the abundance and cost of electrical energy is the determining factor as to whether such enterprises as additional irrigation, electrochemical propositions or activities involving the use of the electric furnace shall or shall not be undertaken.

Pooling of Power Resources.

During the war it was found necessary, in order to increase production, to pool the resources of the nation. Power for operating our industries was demanded as never before and on very short notice. One of the expedients resorted to in keeping abreast of these unprecedented demands was the pooling of power resources through interconnection of adjacent systems.

New experiences were encountered and many economies were effected. Those who came in contact with the larger aspects of these war problems and participated in working out their solutions learned that the methods developed and applied under the stress of war were in fact destined to become of even greater importance under conditions of peace.

There is, therefore, as a result a well-defined movement at the present time looking to the unification of the power systems of certain sections of the country, a movement which, once it gets under way, will gradually spread over the entire country.

The industry has passed successively through the periods of the isolated plant, the individual central-station plant, with its more or less limited distribution lines, and is now in the period of the central-station system of a number of generating plants, hydro and steam, connected to the transmission network of the utility. The next period is to be that of the unification of the power resources of large subdivisions of the country.

In this unification plan the entire power requirements of the district, comprising at first possibly a single state, later several states and eventually the entire country will be treated as a co-ordinated whole. The factory, the mine, the locomotive and the home will be fed from networks of immense proportions extending great distances and deriving energy from generating plants containing the most economical prime movers, located at points where low-priced fuel or water power is available. Such trunk systems, due to the diversified use of energy by the great variety of users served and because of the ease with which energy from flood waters on one system might be absorbed, thereby making possible the impounding of the maximum amount of water on another system, and because of the ability to absorb energy produced by regeneration of electric locomotives on descending grades, will operate at a very high load-factor and the cost of producing energy will be at a minimum figure.

Diversity in Use Is a Big Factor.

The diversity in use between individual networks, many of which would be fed from the trunk system, would be of immense advantage in keeping down to a minimum the capacity and investment in generating plants required. Advantage would be taken of seasonal variations in climatic conditions through the interconnecting network and would result in a steady supply of power in certain sections, on the watersheds of which for the time being there might be serious water shortage.

Such trunk systems would fit in admirably with hydroelectric development and the utilization of large units of higher efficiency, as there would be an outlet for all that the plant could put out during the seasons of high water and at the same time catch, in such impounding reservoirs as there might be available, excess flood water. This would mean the highest possible yearly load-factor for the hydro plant, a very important matter because of the relatively high fixed charges.

Another phase of such an interconnected system is the possibility of fuel-oil saving, which in the Pacific Coast states is rapidly becoming an imperative necessity. The two largest central-station companies in California have found it

necessary, in spite of their large hydroelectric developments, to consume oil at a rapidly increasing rate, this increase being from 1,047,886 bbls. in 1916 to 3,088,145 bbls. in 1919, as shown by the following totals for the two companies:

	Barrels of oil consumed
1916	1,047,886
1917	1,596,149
1918	2,073,016
1919	3,088,145

While this represents only a small proportion of the total consumption for all purposes in the local market, it does reflect the trend in the increase of fuel oil consumption.

Auxiliary Benefits of Hydroelectric Development.

Further development of hydroelectric power will mean not only an important direct saving in fuel consumed by the central stations, but also a much larger saving in fuel consumed by other large power users in California, who would be glad to utilize electric power if it were available.

The power shortage at present existing in California does not prevail in the other states of the West, but the demands for power in the other western states is rapidly approaching the maximum capacity of the central stations therein and if further development is not vigorously pushed the power shortage conditions of California will be duplicated in practically every western state.

It is furthermore becoming of importance that the remaining supply of crude oil be conserved in so far as possible for its more valuable products of gasoline, mineral oils, asphaltum, etc., and for such uses as marine fuel and other power purposes where electric power from hydro plants is not available. This represents the highest type of conservation and its ultimate development lies in the maximum utilization of hydroelectric power and the transmission and distribution of this power through a comprehensive interconnected system providing for the highest and most efficient use of the generating plants.

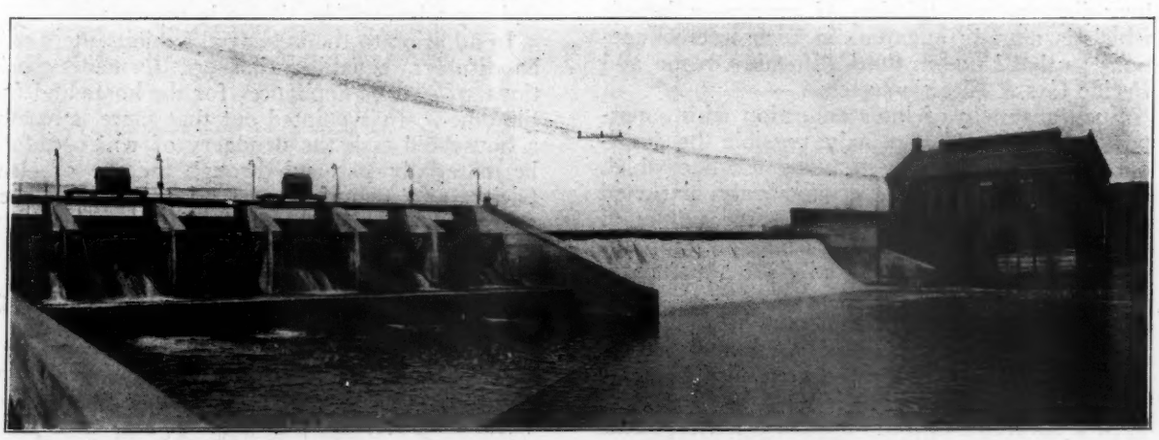
It is of interest to note that much has already been accomplished in California in making a start toward the establishment of a trunk system. During 1918-1919 there were two sets of interconnected networks in the state, one in the northern, the other in the southern portion. The control of each system was under the management of a power supervisor. As a result of this arrangement there was effected a saving of 300,000 bbls. in 1919, representing $450,000. In the latter part of 1919 a connection of the northern system with the California-Oregon Power Co. extended that network into the state of Oregon. Within recent weeks a connection between the lines of the Pacific Gas & Electric Co. and those of the San Joaquin Light & Power Corp. has tied the two networks into one and there is now a continuous trunk extending from the southern part of Oregon to the Mexican border.

Within recent months the systems of the Montana Power Co., Washington Water Power Co. and Puget Sound Power & Light Co. have been joined up by the building of the transmission line of the Chicago, Milwaukee & St. Paul railway across the Cascade mountains.

While it does not fall within the scope of this report to deal with this subject in detail, attention is called to the recent paper by W. S. Murray and others in the March *Journal* of the American Institute of Electrical Engineers on the economic supply of electric power for the industries and the railroads of the northeast Atlantic seaboard. This article deals with a so-called super-power zone and sets forth the results of some interesting economic studies of the power supply contemplated for this important section of the United States.

The importance and magnitude of hydroelectric development as contemplated within the next

Low-Head Water-Power Development on the St. Joseph River in Michigan



The generating station at Berrien Springs, Mich., shown in the accompanying illustration, is one of five plants supplying the lines of the Indiana & Michigan Electric Co. A deep valley extending for several miles above the site of the dam provides a water reservoir and allows for a certain amount of storage capacity. A head of from 20 to 22 ft. is available most of the time, although lower heads have to be used during dry periods. Four 1800-kw., three-phase, 2300-volt Westinghouse horizontal alternators comprise the generating equipment. Exciters are direct connected to each main driving shaft. The individual units are capable of carrying 2500 kw. each and the maximum daily load averages about 8000 kw. Each generator is connected to a three-phase, oil insulated, water-cooled transformer which raises the potential to 27,000 volts for transmission over the five outgoing lines. Local lighting and power circuits for the city are supplied at generator voltage, and two rotary converters in the station supply power to the nearby interurban line. The passage of suitable national water-power legislation should result in the establishment of thousands of plants like this all over the country.

few years should be clear to the most casual reader. In order that this development may be encouraged, it is the recommendation of this committee that due attention be given to the matter of favorable legislation. In California, in particular, unsatisfactory state laws hinder the ready development of water powers which are assumed to be in conflict with other riparian rights on the stream. It should be the endeavor of this body and its members as individuals to remedy this and other unfavorable conditions which discourage investment. Important legislation is now before Congress, covering both the development of water power upon navigable streams and the broader question of water rights on government land. As urged elsewhere in this report, it seems advisable that a permanent committee be established by the National Electric Light Association to represent the interests of the electrical industry as a whole in the formulation of rules and regulations which shall govern the application of these measures.

It is further advocated that the policy of trunk line transmission, at 220,000 volts and over, be advanced as an economic possibility. All future activity in hydroelectric development the nation over should look toward unification and in a measure toward standardization of high-voltage busbar installation. As particular instances, the early future should see giant power lines of 220,000 volts and upwards extending north and south through California, thence on upward to the Columbia and into the industrial center about Seattle, and thence over the Cascades into Spokane and Butte. It seems apparent that such systems will not only make feasible the most economic developments but will also do much to equalize the variations in rainfall to be expected from season to season, through the possibility of transferring power from one section where water is plentiful to another where a shortage obtains. This does not necessarily mean the actual transference of large blocks of power over tremendous distances, but the shifting of load from one power system over into another and then on into another makes this possible without the actual long-distance transmission of energy—a benefit which is already apparent in such interconnections as that between the California-Oregon and Pacific Gas & Electric systems.

Such a system of interconnection with superpower lines would also make possible the development of smaller powers along the line which could not otherwise be economically marketed and it would lay the foundation for supply of power for the electrification of steam railroads which popular demand is daily bringing nearer consummation.

The fact has been brought out in this report that $710,510,000 is needed to finance hydroelectric construction for the next nine years in the West alone. The public must be brought to such a favorable attitude toward electric utilities that it will be prepared to furnish this money. How this may be brought about is a subject worthy of earnest consideration. It is obvious that the public is as closely concerned in the need for this development as the power companies themselves, and it seems logical that the benefits to each citizen need only be pointed out to him to gain his full interest and co-operation. The widespread education of the community should then be undertaken along the lines of the "self-interest" appeal.

It should further be pointed out that the success of this financing is likewise contingent upon a broadminded policy on the part of regulating commissions which must allow sufficient returns to the power companies so that the investor may see a possibility of fair return on his money. Indeed, it may safely be said that upon the adequate protection of the investor hinges the entire matter of power company financing. The function of a public utility commission has two aspects—the safeguarding of the interest of the public and at the same time a consideration of the welfare of the companies regulated to the extent that they are enabled to maintain a state of health and adequate growth. The broadest spirit of co-operation between such regulating bodies, the electrical industry and the public cannot be urged too strongly in order that the needs of the commonwealth may best be served.

INDUSTRIAL DISPLAY BIG FEATURE OF NEW YORK SHOW.

With practically all the space on the main floor spoken for and reservations being made on the second and third floors, the New York Electrical Exposition promises to be more interesting this year than ever before. The exposition will be held at the Grand Central Palace, Lexington avenue and 46th street, New York City, from Oct. 6 to 16.

A feature which will be of great importance in these days of high-speed production is the industrial display, occupying the greater part of the second and third floors. Here will be shown the different types of electrically operated machines. Electric spot welders will be shown doing the work that has done away with the old-time rivet process. Electric lathes and drills will be arranged to show the advantages of the motor-driven factory over the shop that is encumbered with belts and shafting. Electric industrial trucks, such as are used by railroads and factories, will be shown in operation.

In addition to the industrial exhibits there will be displays, equalling those of former expositions, of electric appliances for the home and for the office. It is pointed out that there is hardly a household task the drudgery of which cannot be materially lessened through the use of electricity, and manufacturers of these appliances are going to make the most of this opportunity to show their wares to the buying public.

LIBRARY OF CONGRESS WANTS TWO MISSING MAGAZINES.

The Library of Congress is desirous of obtaining issues No. 5 and 6 of Volume 53 of *Electrical Engineering,* published in May and June, 1919. These issues are missing from the library files, making the set of the publication incomplete. *Electrical Engineering* was consolidated with ELECTRICAL REVIEW in June, 1919, and this office has no copies of the May or June, 1919, issue in its possession. Any person having copies in their possession will confer a favor by writing to the librarian of Congress.

Importance of Short-Circuit Ratio in Synchronous Machines

Explanation of a Graphic Method for Determining Characteristics of Synchronous Machines Either When Operating as Alternators or as Motors—Typical Curves Obtained by Use of Such a Method

By THEO. SCHOU

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If, in case of a synchronous machine, the short-circuit ratio is known; that is, the ratio between the field current at no load, normal voltage, to the field current necessary to establish normal amperes per terminal at short-circuit; then it is possible to determine closely enough for practical purposes different characteristics which are of importance in connection with synchronous machines when operating either as alternators or synchronous motors.

In what follows a short explanation will be given of a graphic method used, and characteristic curves obtained, by applying such a method.

Determination of Field Excitation at Various Power-Factors.

Fig. 1 shows the magnetic characteristics, or saturation, of a machine where the effect of iron saturation is eliminated. The no-load saturation OD, and the 0% power-factor (normal amperes) saturation AK, therefore, appear as straight parallel lines. The field current at no load, normal voltage, $I_o = OB$, and the field current at short-circuit, with normal amperes per terminal, $I_s = OA$. The normal short-circuit ratio, therefore, is I_o/I_s.

Neglecting the ohmic drop, which in the case of an alternator adds to, and in case of a synchronous motor deducts from, the normal voltage, we have for the field current at full load, 100% power-factor:

$$I_{100} = \sqrt{I_o^2 + I_s^2}$$

Due to the fact that the effect of the ohmic drop in the armature winding has been neglected, the values of field current at various power-factors (lagging for alternators and leading for synchronous motors), as computed by this

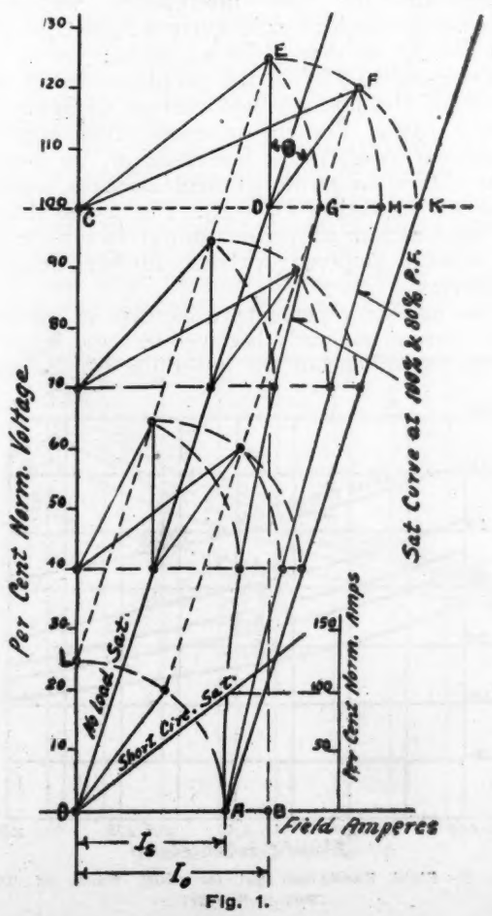

Fig. 1.

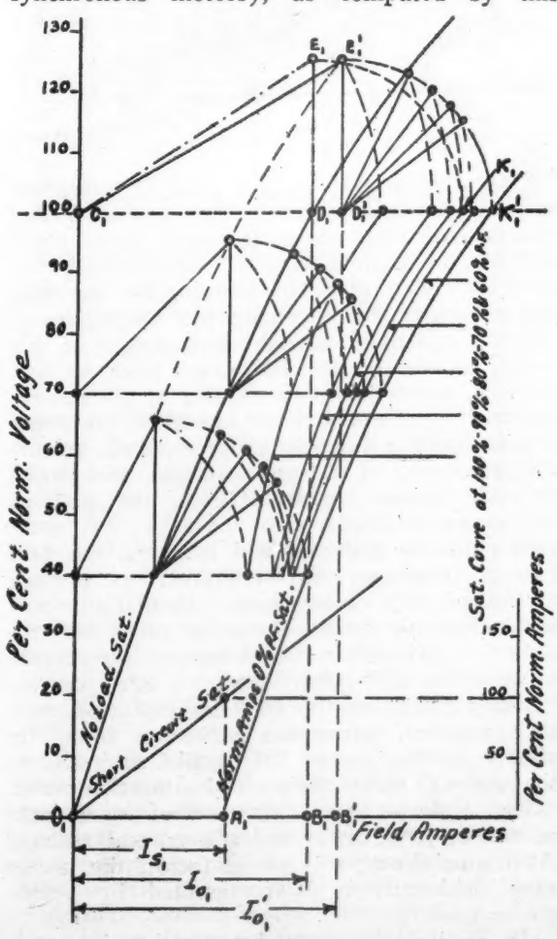

Fig. 2.

method, will be slightly optimistic in case of alternators, and slightly pessimistic in case of synchronous motors.

In order to construct a point on any full-load kv-a. power-factor curve, we draw the horizontal line CK, and a vertical line through D. Now vector CD is equal to I_o, and if we make vector DE equal to I_s, then vector CE is, to the scale of field amperes, the field current necessary for operation at full kv-a. load, 100% power-factor. Point G on the 100% power-factor curve, at normal voltage, is found where the circle of radius CE, and center at C, intersects the normal voltage line CK.

As the field excitation in this case is directly proportional to the voltage, we can locate points on the 100% power-factor, normal amperes curve, at any voltage, by simply moving vector

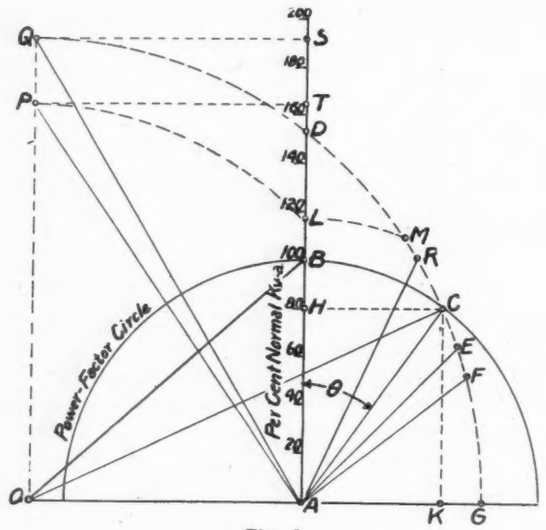

Fig. 3.

DE parallel to itself, so that point D traces the no-load saturation curve. Fig. 1 shows construction of such points at 100%, 70%, 40%, and 0% of normal voltage. Maintaining the same load in amperes, but changing the operating power-factor, will not change the magnitude of vector DE, but the angular displacement of this vector to vector CD will change from 90 deg. at 100% power-factor to 180 deg. at 0% power-factor. If, therefore, we wish to construct a point on the full-load amperes, 80% power-factor curve, at normal voltage, we would have to displace vector DE to the position DF, where $\cos\theta = 0.8$. Vector CF now represents, to scale of field amperes, the field current necessary for operation at normal kv-a. load, 80% power-factor. Point H, at normal voltage, is found where the circle with radius CF, and center at C, intersects the normal voltage line CK. For other voltages, corresponding points on the 80% power-factor, normal amperes, saturation curve are found by simply moving vector DF parallel to itself, so that point D traces the no-load saturation curve.

Fig. 1 shows the construction of such points at 100%, 70%, 40%, and 0% normal voltage. At normal kv-a., 0% power-factor, the necessary field current is represented by vector $CK = I_o + I_s$.

In reality, the no-load saturation is not a

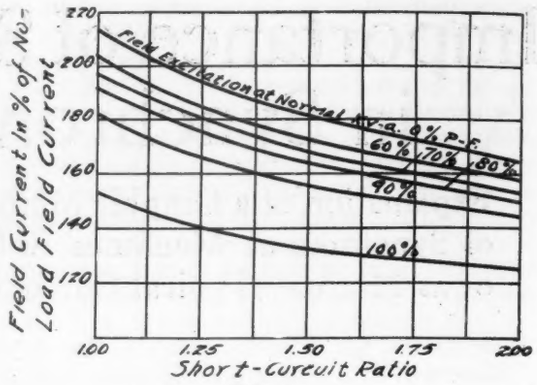

Fig. 4.

straight line, but a curve, as indicated by Fig. 2, which takes into consideration both the magnetic characteristics of the air gap, which, in terms of the necessary field amperes, increases proportionally to the voltage, and the iron. The saturation of the iron, in terms of the necessary field amperes, increases faster than the increase in voltage. Due to this fact, both the no-load and normal amperes, 0% power-factor saturation (as shown in Fig. 2) are curved lines, and not parallel; that is, vector $D_1 - K_1'$ is not equal to I_{s1}. Applying the method as discussed above, we would, for full kv-a. load, at 0% power-factor, obtain a field current corresponding to vector $C_1 - K_1$. The necessary field current for this load condition, however, is corresponding to vector $C_1 - K_1'$, or in terms of field amperes, we would fall short, corresponding to vector $K_1 - K_1'$. In order to compensate for this discrepancy we will increase the no-load field current $I_{01} = C_1 - D_1$ to $C_1 - D_1'$, so that $D_1' - K_1' = I_{s1}$.

Referring to Fig. 2, this would mean an increase of the no-load field current of approximately 13%. For the necessary field current at normal kv-a., 100% power-factor, we would then obtain, in terms of field amperes, vector $C_1 - E_1'$ instead of $C_1 - E_1$. Fig. 2 also shows the construction of various power-factor curves at normal amperes without further detailed comments.

The necessary percentage increase of no-load field current obviously becomes less and less the lower the voltage or the lower the iron satura-

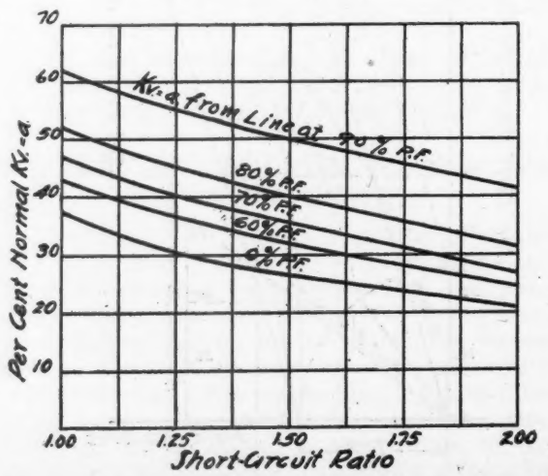

Fig. 5.—Field Excitation Set for 100% Kv-a. at 100% Power-Factor.

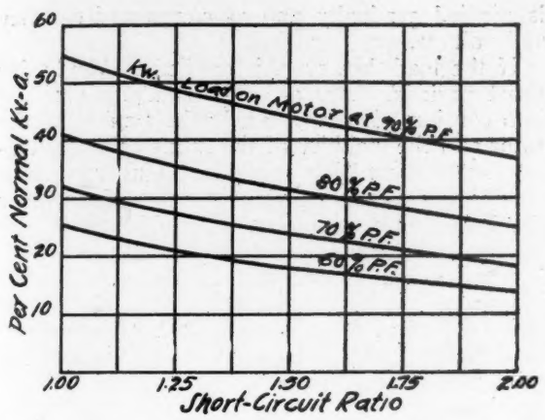

Fig. 6.—Field Excitation Set for 100% Kv-a. at 100% Power-Factor.

tion is. It is seen from Fig. 2 that on lower voltages the two saturation curves (the no-load, and the normal amperes, 0% power-factor) are practically straight, parallel lines. At normal voltage conditions, however, this percentage may vary from approximately 10% with high-speed machines to as much as 20% with slow-speed machines.

At a given voltage the short-circuit ratio I_o/I_s changes directly as the load; that is, it increases or decreases as the load decreases or increases. In this connection it should be noted that the normal rating of a synchronous machine, calling for a certain temperature rise, is more or less based on the short-circuit ratio. For instance, an alternator may be rated as a 35 deg. C. machine, with a short-circuit ratio of 1.8. Rating this same alternator as a 40 deg. C. machine would lower the short-circuit ratio to, say, 1.56, and as a maximum rated 50 deg. C. machine, the short-circuit ratio would be approximately 1.3.

The rating of a synchronous machine of ordinary design characteristics is generally limited, at lower power-factors, by the field heating. At unity power-factor, however, the armature current sets the limit, both as to temperature rise and other characteristics, such as practical regulation characteristics with alternators, and

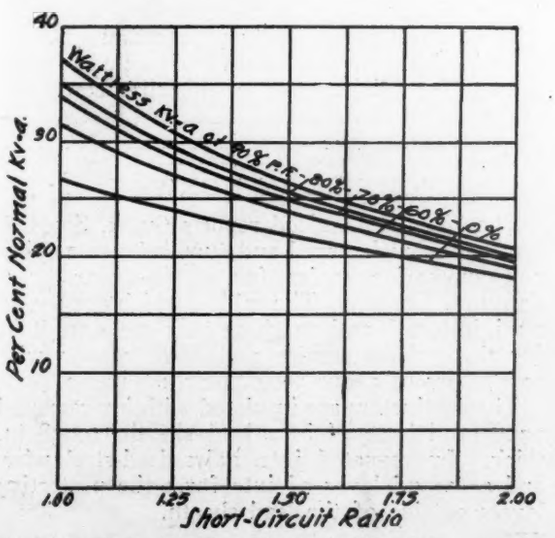

Fig. 7.—Field Excitation Set for 100% Kv-a. at 100% Power-Factor.

feasible pull-out torque with synchronous motors.

In Fig. 3 vector OA and vector AB are displaced from each other 90 deg. Vector OA represents the field amperes at no load, normal voltage, with a certain percentage increase to allow for the iron saturation. Vector AB represents the field current necessary for obtaining normal amperes per terminal at short-circuit, and is directly proportional to the load. The ratio of OA/AB is the normal short-circuit ratio. In Fig. 3 the percentage increase given vector OA is approximately 15%, and the ratio of OA/AB, as per Fig. 3, represents, therefore, a short-circuit ratio of 1.00. Vector OB represents the field current necessary for operation at full kv-a. load, 100% power-factor.

Determination of the Kv-a. Rating at Various Power-Factors.

Let us assume that the synchronous motor to which this diagram applies is a maximum rated machine and based on full kv-a. rating at 80% leading power-factor, with a permissible temperature rise not to exceed 50 deg. C. In the diagram (Fig. 3) vector AC, which has an electrical displacement of θ deg. (cos. $\theta = 0.8$) from vector AB, represents, therefore, a normal kv-a. load at 80% leading power-factor; vector OC represents the field current necessary for

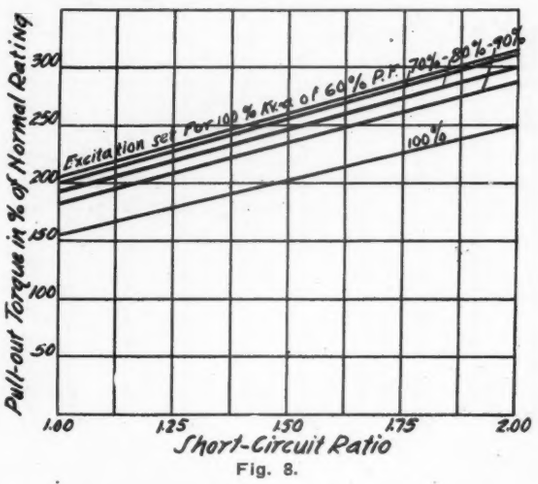

Fig. 8.

such condition of operation. As mentioned above, the kv-a. rating at lower power-factors is limited by field heating, or, in this case, by a field current corresponding to vector OC. In order to find what kv-a. load this motor will carry at various other leading power-factors, it is necessary only to draw an arc DCG, with a radius OC and center at O, then lay off the desired kv-a. vectors at various leading power-factors. The magnitude of these kv-a. vectors is then given by the distance from A to the intersection points of these vectors with the arc DCG. For instance, referring to Fig. 3, this motor will carry OE kv-a. at 70% leading power-factor, or, to scale (Fig. 3) approximately 92% of normal kv-a.; at 60% leading power-factor the motor would carry OF kv-a., or approximately 87% of normal kv-a., and at 0% power-factor, or at a condition of operation corresponding to the motor floating on the line as a synchronous condenser, AG kv-a., which

would mean approximately 77% of normal kv-a. rating.

By projecting the points *C*, *E* and *F* on the vertical line *AB* we obtain the kw. components, and by projecting the same points on the line *AG* we obtain the wattless components of these kv-a. vectors. For instance, the motor kv-a. vector *AC*, at 80% leading power-factor, would resolve itself in *AH* kw., and *AK* wattless kv-a. This would mean that the motor operating at 80% leading power-factor could carry a mechanical load (including inherent losses in the motor) of 80% of its kv-a. rating at 80% power-factor, and at the same time apply a corrective wattless component to its system, for power-factor correction, of 60% of the motor kv-a. rating at 80% leading power-factor.

It is seen from Fig. 3 that, as far as the field heating is concerned, the motor operating at unity power-factor could carry a kw. load corresponding to vector *AD*, or 154% of its kv-a. rating at 80% power-factor. At this 100% power-factor load, however, the heating, as caused by the armature current, would become excessive. The kv-a. rating, however, of

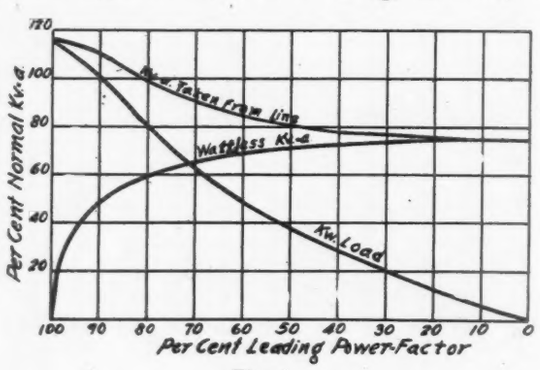

Fig. 9.

the motor at 100% power-factor is usually larger than the 80% power-factor rating. In practical cases the former will be 110% to 120% of the latter.

As indicated in Fig. 3, the kv-a. rating at 100% power-factor, and also at very high leading power-factors, is limited by the arc *LM* of a circle, having its center at *A*, and the permissible kv-a. rating at unity power-factor as the radius. Vector *AR* represents the kv-a. rating this motor will carry at 90% leading power-factor, and is, referring to Fig. 3, limited by the field heating.

Pull-Out Characteristics.

The theoretical pull-out, or the kw. load which will throw the synchronous motor out of step, occurs when the kv-a. vector at 100% power-factor equals the field excitation vector. Referring to Fig. 3, if the field excitation of this motor is set for full kv-a. load at 80% leading power-factor, the pull-out will occur when the kw. load vector *AS* equals the field current vector *OC*. At the point of pull-out, under this condition, the motor will draw *AQ* kv-a. = 223% of normal kv-a., from the line at a lagging power-factor *AS*/*AQ* = 0.86 or 86%. The kw. load at pull-out is found to be 192% of normal kv-a. rating. It is to be understood that this theoretical pull-out applies only when the load is applied gradually and at constant frequency and voltage.

If the load, however, is applied suddenly for short periods, there are other factors entering into consideration, such as flywheel effect of the rotor and the inability of the flux to change during such short time periods. Under such a condition a motor may have three to four times the break-out torque that it would have under steady load conditions.*

It is also a known fact that a synchronous motor, due to its definite pole construction, will carry a load of from 25% to 50% of its normal load without any field excitation; this has not been taken into consideration in the above discussion.

Applying various short-circuit ratios to a diagram as per Fig. 3, we may quickly determine various characteristic curves such as reproduced in Figs. 4, 5, 6, 7, and 8, which are both very interesting and useful.

Fig. 9 shows how the kv-a. taken from line, the kw. load and the wattless component will vary for different leading power factors in a 50-deg. C. rated synchronous motor with a normal short-circuit ratio of 1.25, and limited, as explained above, by the field and armature current. These curves will be found valuable in connection with synchronous motors for power-factor correction.

CADMIUM-VAPOR ARC LAMP GIVES PURE RED LIGHT.

The Bureau of Standards, Washington, D. C., has announced, through Scientific Paper No. 371, the development of a new method of producing a cadmium vapor arc of great brilliancy. It was found that the metal gallium alloyed with cadmium, and since gallium has a boiling point above 1500 deg. C., the vapor-pressure relation which exists between cadmium and mercury is reversed when compared with cadmium and gallium. The cadmium therefore acts as the energy carrier when used in combination with gallium in a quartz lamp.

The cadmium-vapor lamp may be operated with a current of 3 amperes and a drop of 14 volts across the terminals, but gives the best results when operated at about 25 volts. Under this condition a practically pure cadmium spectrum is obtained. The lamp is expected to fill a demand for a light source of this character.

HIGH-VOLTAGE SUBMARINE CABLES FOR USE IN NORWAY.

The *Teknisk Ukeblad* reports that a Swedish firm has manufactured and supplied two 11,000-volt submarine cables for service near Kristiansund, Norway. The cables, which are nearly 2 mi. in length and weigh 52 tons each, are built for three-phase service and have copper wire conductors of about 500,000 cir. mils area.

The conductors are insulated with impregnated paper and inclosed in a lead sheath 0.0938 in. thick. Impregnated jute, galvanized-steel wire, and a second layer of jute form the protective layers outside of the lead sheath.

*This information by courtesy of E. S. Henningsen. General Electric Co.

Limitations of High Vacuum in Actual Practice

Difficulties That Future Developments Must Overcome in Approaching Conditions of an Ideal Condenser—Vacuum Shown to Have Economical Limits—Paper Before N. E. L. A. Convention

By A. D. BAILEY

Chief Engineer, Fisk and Quarry Street Stations, Commonwealth Edison Co., Chicago.

The question of high vacua has interested plant operators recently more on account of the efficient air removal devices now being used. The tendency toward the use of high vacuum condensing equipment has been continually to demand higher vacuum, with the idea that this means great economy. Under ordinary conditions this is admitttedly true, but the conditions under which greater vacua could be obtained introduce a number of factors which may more than offset any possible gain in economy.

It appears that a large number of plant operators have gone on demanding higher vacuum under their present equipment without regard to the difficulties to be overcome. Others have maintained that there is a definite limit to the vacuum obtainable beyond which it would not pay to go. The former advance the usual theoretical reasons for higher vacuum, but produce no actual data to substantiate the claims, which for this reason are nothing more than professional opinions.

On the other hand, the claim that there is a definite limit to economical vacuum has at least partial substantiation by experiment on equipment as it is, but this does not necessarily indicate the possibilities of a turbine-condenser equipment designed originally for high vacuum. By high vacuum is meant an approach to the conditions of an ideal condenser working under average conditions as to temperature and velocity of circulating water.

As no real data are available to show just what the limitations of maximum economical vacuum are, the discussion herein is, therefore, confined mostly to the difficulties and problems that future developments must overcome in approaching the conditions of an ideal condenser. It is ordinarily considered that higher vacuum is a function of the condenser only, but, as a matter of fact, it involves also the design of the turbine, particularly the final expansion, tightness of turbine casing and condenser, and the ability to remove highly rarefied air.

Good Practice in Condenser Operation.

For the purpose of illustration in this discussion, the conditions of a two-pass surface condenser operating in connection with a 30,000 kw. Curtis-Rateau turbine are used and shown in Figs. 1 and 2. These conditions can be considered at the present time to represent good practice, and the opportunities for and chances of further development are as good with other types of generating units, or possibly better.

One of the most important factors governing the maximum vacuum possible is, of course, the amount of air to be removed. Condenser manufacturers claim that the amount of air to be removed from a condenser is directly proportional to the steam condensed. This may be true of a perfectly tight condenser wherein all the air enters by entrainment with the feed water. The experience of actual operation shows that a perfectly tight condenser and exhaust casing is seldom found.

Referring to Fig. 1, it is shown by the curves of partial air pressure and resistance to heat transfer that the amount of air to be removed was not proportional to the steam condensed, but was actually more at low loads than at high

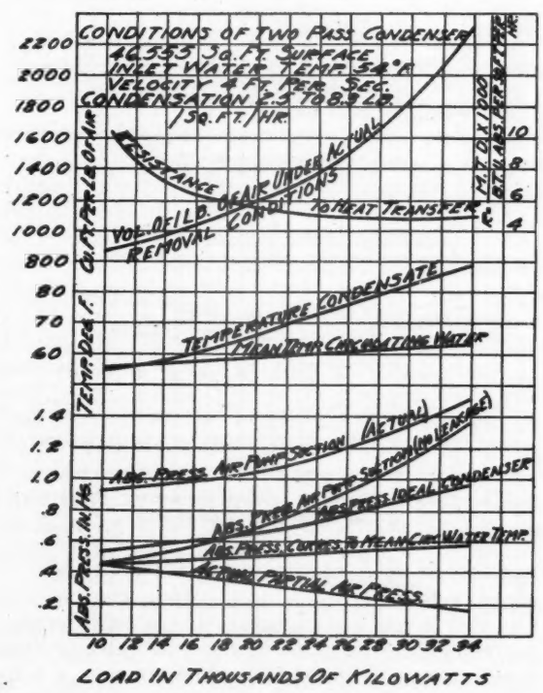
CONDITIONS OF TWO PASS CONDENSER
46,555 SQ. FT. SURFACE
INLET WATER TEMP. 54°F.
VELOCITY 4 FT. PER SEC.
CONDENSATION 2.5 TO 8.9 LB. /SQ. FT./HR.
RESISTANCE OF AIR UNDER ACTUAL CONDITIONS TO HEAT TRANSFER
VOL. OF I.D. AIR REMOVAL
TEMPERATURE CONDENSATE
MEAN TEMP. CIRCULATING WATER
ABS. PRESS. AIR PUMP SUCTION (ACTUAL)
ABS. PRESS. AIR PUMP SUCTION (NO LEAKAGE)
ABS. PRESS. IDEAL CONDENSER
ABS. PRESS. CORRES. TO MEAN CIRC. WATER TEMP.
ACTUAL PARTIAL AIR PRESS.
LOAD IN THOUSANDS OF KILOWATTS

Fig. 1.—Curves Illustrating Some Ideal Condenser Conditions With No Leakage of Air.

loads. This fact is an indirect indication that the air in the condenser was largely a matter of leakage rather than entrainment with the feed water. Thus it can be seen that a condenser which is tight under all load and temperature conditions offers opportunity of increased vacuum. The vacuum conditions of no air leakage or entrainment are shown in Fig. 1 for all load conditions. This is probably impossible of

attainment, but there is still a chance of improvement in this respect.

A limiting factor of actual vacuum is the temperature of the condensate, inasmuch as a vacuum greater than that corresponding is impossible. It has been claimed that there were high-vacuum possibilities in reducing the condensate temperature, the limiting possibilities of which would be a mean of the circulating water temperatures. Referring to Fig. 1, it may be noted that this hypothetical vacuum is greater than that possible with an ideal condenser operating under the conditions stated and is therefore impossible. Any gain in economy resulting from increasing the vacuum by reducing the condensate temperature would have to more than balance that lost to the feed water temperature. A heat balance shows only slight possibilities at high loads.

The most important limitations to high vacuum have to do with the design of the turbine itself, which is designed for a definite vacuum at its most economical load. The volume of a pound of steam at 1 in. absolute pressure is

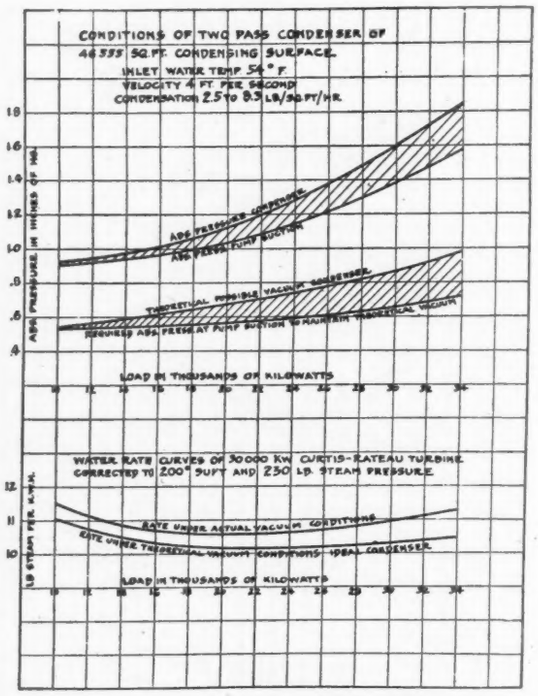
CONDITIONS OF TWO PASS CONDENSER OF
46,555 SQ. FT. CONDENSING SURFACE.
INLET WATER TEMP. 54° F.
VELOCITY 4 FT. PER SECOND
CONDENSATION 2.5 TO 8.5 LB/SQ.FT/HR.
ABS. PRESSURE IN INCHES OF MG.
ABS. PRESSURE CORRESPONDING
AND EQUAL FINAL SUCTION
THEORETICAL POSSIBLE VACUUM CONDENSER.
REQUIRED ABS. PRESS. AT PUMP SUCTION TO MAINTAIN THEORETICAL VACUUM
LOAD IN THOUSANDS OF KILOWATTS
WATER RATE CURVES OF 30000 KW CURTIS-RATEAU TURBINE
CORRECTED TO 200° SUPT AND 250 LB. STEAM PRESSURE.
LB STEAM PER K.W.H.
RATE UNDER ACTUAL VACUUM CONDITIONS
RATE UNDER THEORETICAL VACUUM CONDITIONS IDEAL CONDENSER
LOAD IN THOUSANDS OF KILOWATTS

Fig. 2.—Curves Showing Actual Condenser Performance Under Working Conditions.

652 cu. ft. and at 0.5 in. absolute pressure is about 1260 cu. ft.—almost twice the volume. On the present equipment this would mean a corresponding increase in the exit velocity from the last row of buckets, which means a large increase in the lost kinetic energy which is in proportion to the square of the velocity. Such incomplete data as are available show that, at low loads of from 10,000 to 12,000 kw. (Fig. 2), there is an increase in economy of about 3 to 3.5%, while at higher loads no increase is indicated over a range of 1 in. to 0.5 in. absolute pressure. These percentages at 0.5 in. absolute pressure were, however, assumed as actual conditions of 0.5 in. absolute condenser pressure could not be obtained.

Turbine bucket designs require that the speed of the bucket bear a proper relation to the steam velocity. If this relation is to be carried out under higher vacuum conditions, difficulties of design in the last stage buckets nullify any possible gain in economy. If buckets are made too long, the velocity conditions at the tip on account of the flare would be such that steam would flow through without doing any work. If high steam velocities are used in the last stage it must necessarily follow that a greater proportion of the work done must be accomplished there, and this would mean less efficiency than if designed for a lesser proportion of work.

It would then appear from the foregoing that there are limitations to economical vacuum, but owing to the lack of complete data pertinent to this question no exact limit for any set of conditions can be stated at this time. It does not appear that the conditions of an ideal condenser, or vacua of from 0.5 in. to 0.9 in. under the conditions as shown by Fig. 1, are impossible of attainment, if increased economy is the governing factor.

LATEST NEW YORK POWER PLANT TO HAVE LARGE UNITS.

Generators Are to Operate at 1200 R.p.m. and Carry Loads Up to 40,000 Kw. for Short Periods of Time.

The two 60-cycle turbogenerators which will be installed in the new Hell Gate station of the United Electric Light & Power Co., New York City, will be of the tandem-compound type, each rated at 43,750 kv-a. at 80% power factor or 35,000 kw. They will be designed to carry peak loads of 40,000 kw. for short periods. These units, which will be built by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will be similar to the 60-cycle units installed in the Northwest station of the Commonwealth Edison Co., Chicago, with the exception that the newer units will have a rating of 43,750 kv-a., as compared with 35,300 kv-a. for the older units. The generators will be designed for 13,200 volts and will operate at 1200 r.p.m.

The turbine will be designed to operate at 220 lbs. steam pressure, 200 deg. F. superheat and 29-in. vacuum, and will have reaction blading throughout.

SYNCHRONOUS MOTOR TO CORRECT POWER-FACTOR OF PLANT.

A set of transformers aggregating 450 kv-a. and a 400-hp. synchronous motor were recently installed to supply one customer of the Rochester Gas & Electric Corp. The transformers were hung overhead and comprise the largest installation of this character on the system.

These transformers will carry the general load in the customer's plant with the exception of an air compressor, which will be driven by the 400-hp. motor, supplied direct from primary voltage. A second compressor will be connected to this same motor, at some later time, when additional air capacity is required. It is anticipated that the entire service will operate at unity power-factor without other corrective means than the single synchronous motor.

Lubrication as Applied to Power-Plant Operation

Oils and Other Lubricants Should Be Chosen for the Particular Service Expected of Them—Selection Made on Basis of Judgment Supported by Chemical and Practical Operating Tests in Plant

By ROBERT JUNE

An accurate knowledge of lubricants and lubrication on the part of operators and engineers is of vital importance to the economical operation of the power plant. This is true because, even in a plant where the lubricants used are the best adapted for each particular service, the losses of power due to friction may range from 5 to 30%. With improper lubricants the losses due to friction may run much higher, and to these losses may be added the losses in depreciation of equipment caused by wear on bearings, guides, cylinders, etc.

As a general proposition, losses due to friction will be found to vary from 8% in central stations, where energy is produced but not utilized, to 25% in plants such as iron and steel mills, where manufacturing processes are carried on. Reducing this friction power loss by 10% will generally pay for all lubricants used in the course of a year. Hence, the proposition of saving oil does not cause as much concern as does the problem of saving power, for by saving power the cost of lubricants may be offset several times over. This is an aspect of the problem of lubrication that is, unfortunately, not generally appreciated by the plant manager and superintendent or by the operating engineer. Engineers know they get more satisfactory results with certain lubricants than with others, but the value of these results in dollars and cents is almost never placed before them in such a manner that they can fully appreciate their importance.

Friction and Lubrication.

The function of a lubricant is to reduce friction, which may be defined as the resistance or binding action encountered when one body is drawn over another. Friction will vary with the character of the materials, the smoothness of the surfaces and the pressure exerted to force them together. Fig. 1 illustrates the conditions

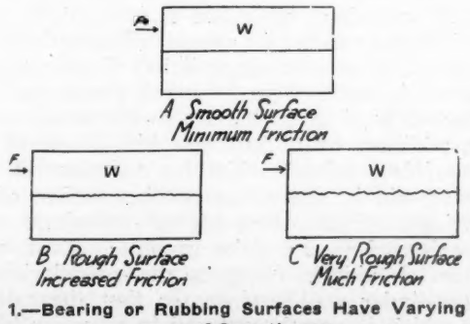

Fig. 1.—Bearing or Rubbing Surfaces Have Varying Degrees of Smoothness.

existing when bodies of different degrees of smoothness are drawn over each other. It is evident that as the roughness of the surfaces increase there is a greater tendency for the projections to lock together, and that greater force will be required to draw the bodies with rougher surfaces over each other than to draw those with smoother surfaces. This clearly shows the importance of giving bearings, guides and cylinders the smoothest possible finish. Unfortunately, we never can obtain complete smoothness of surfaces with any metal and must, therefore, content ourselves with obtaining the smoothest surface possible with the particular materials employed.

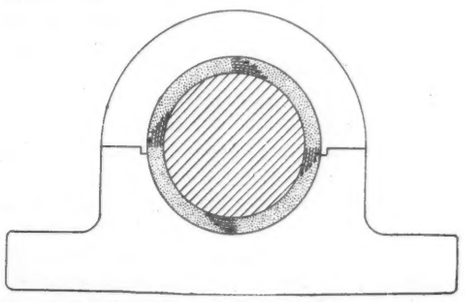

Fig. 2.—Illustrating the Relative Speeds of the Various Layers of Oil Surrounding a Shaft in a Bearing.

The purpose of lubrication is to interpose a film of oil betwen the moving surfaces, thus forcing them apart so that actual contact of metal with metal is avoided, leaving only the fluid friction of the lubricant. The expression "fluid friction of the lubricant" may be taken as referring to the resistance of the oil to the force tending to pull its particles apart. This can best be understood by referring to Fig. 2, wherein an attempt has been made to show the condition of the lubricant in a bearing in action. It will be seen that the oil which is in closest contact with the shaft moves at a much faster rate than that which is in closest contact with the bearing. In other words, we have what may be termed a number of layers of oil between the shaft and the bearing, each moving at a progressively faster rate, depending upon their proximity to the shaft.

It is this condition of fluid friction set up in the oil which makes the choice of a proper lubricant extremely important. The reason for this is that operating conditions vary widely, depending upon the pressure tending to force the bodies together, the temperatures existing at the point at which the lubricant must be used, etc.

Obviously no one lubricant can be expected to meet all conditions of services, so the lubricant best adapted for each particular service must be selected.

Characteristics of a Good Lubricant.

A good lubricant is one which, for the particular service under consideration, possesses the following characteristics: It should prevent the surfaces from coming into contact under conditions of maximum pressure, ability to do this being a function of viscosity or, as it is sometimes called, "body" of the oil; it should absorb and carry away heat, have a low co-efficient of friction, be of the lowest viscosity consistent with the work required, and free from any tendency to oxidize. Its temperature of vaporization (flash point) should be high, its freezing point low, and it should be free from acids.

Having outlined the qualifications of a good lubricant for any particular service, the characteristics of the various lubricants available should be examined to see the services for which they are adapted. Lubricants may be divided into various classes such as vegetable oils, animal fats, mineral oils, solid lubricants and greases. Each of these classes possess certain definite characteristics.

Vegetable oils consist principally of linseed, castor, rapeseed, resin, cotton seed oil, etc. These do not, in themselves, possess lubricating properties of any great practical value, since they oxidize at comparatively low temperatures and are apt to become thick and gummy in a short time. These oils are, therefore, of very poor cold test, congealing at a comparatively high temperature, thus making them inconvenient for use in cold weather. The principal use of these oils for lubricating purposes is confined to the compounding of oils for certain services.

Characteristics of Various Lubricants.

Animal oils in general use are tallow, neatsfoot oil, lard, sperm oil, wool grease, fish oils, etc. Individually these oils possess the same objectionable features as vegetable oils and are, therefore, seldom used in a pure state, but are frequently compounded with the mineral oils. The reason for this compounding, when done, is that the compound oils in general have better lubricating qualities than pure mineral oils of the same viscosity or body. In cylinder lubrication, especially in the presence of moisture caused by steam, the addition of 2 to 5% of tallow seems to increase the lubricating effects. When used in these proportions, the bad effects from the decomposition of the tallow, which may set free acids which attack the metal, and the bad effects of gumming or oxidation are not so great as to overbalance the advantage of better lubrication.

Mineral oils have many advantages as lubricants over animal or vegetable oils. They are cheap and, being of non-organic origin, are of a more stable chemical composition, and do not tend so readily to change their condition by becoming rancid, thick or gummy from exposure to the air, and they have no corrosive action on metals. By what is known as fractional distillation, mineral oils can be separated into a great many different grades, from the lightest spindle oils to the dense, heavy cylinder oils. They are of lower cold test and not so liable to spontaneous combustion as the animal fats. They present a wider range of lubricating properties than oils derived from animal or vegetable sources, the thinnest being more fluid than sperm oil and the thickest more viscous than fats and tallows.

Mineral oils may be separated into various groups and classified as distilled, natural and reduced oils. Distilled oils, which are produced by distillation from crude petroleum, are so treated by various processes, in which alkalies and acids are employed, as to appear in the finished product as transparent fluids of extremely stable composition. Natural oils are prepared crude petroleums from which grit, suspended and tarry impurities have been removed. They are usually dark, opaque and rich in lubricating properties. Reduced oils or, as they are sometimes termed, heavy natural oils are oils from which the lighter hydrocarbons have been evaporated, and from which the tarry residue has been removed by filtration.

Use and Characteristics of Solid Lubricants

Mica, soapstone and dry graphite which are the principal solid lubricants are mixed for use with greases or oils. Their principal use is to be found where great weights have to be carried on small areas, and is usually confined to low speeds. The coefficient of friction for solid lubricants is high, and they are, therefore, not particularly economical. Better results can usually be secured by the use of larger bearing surfacs, but, when design does not permit of these larger surfaces, there is a real field open for their use. Under certain conditions of speed, solid lubricants will sustain pressures under which no liquid would work.

Crystalline or flake graphite is dense and compact and is not easily reduced by crushing between the fingers, so that the individual particles maintain their size. Amorphous graphite, under pressure, continues to be reduced in size until the particles are no longer evident to the touch. Flake graphite is the better lubricant because it has good wearing qualities and adheres to metallic surfaces with which it comes in contact. The value of flake graphite as a lubricant lies in its property of filling any irregularities that exist in a bearing surface, thus reducing the roughness and producing a better surface for lubrication with oil or grease. Neither form of graphite is affected by heat.

Graphite is of value as a lubricant for steam-engine cylinders, provided it is used in moderation and not fed in excess. The entire value of graphite as a lubricant is lost if an excessive amount is used. When the valve seats and cylinder walls of an engine are badly cut or scored, the addition of a little graphite (several teaspoonfuls), mixed with the cylinder oil, will greatly aid in smoothing up the surface of the bearings. For steam-engine cylinders using superheated steam, flake graphite is of great value. It aids in filling up the irregularities of the cylinder wall surfaces so that the cylinder oil, which is greatly reduced in viscosity by the

high temperatures found in these cylinders, will have the best possible surface conditions to work on.

In order to obtain a clear idea of the value of graphite as a lubricant, the engineer must appreciate the fact that graphite, to be efficient, must identify itself with the metallic surfaces to be lubricated. Its function is to fill up the pores and depressions in the surfaces, giving them a smooth, polished finish. Lubricating oil must then be introduced between the rubbing surfaces so as to produce a film, which will be more efficient in its results because of the reduced frictional resistance that will have to be overcome.

The specific gravity of graphite being 1.81 is greater than that of oil. For this reason it will settle out on standing so that it is not possible to permanently suspend graphite in oil. A mixture of oil and graphite should never be put in an oil cup or sight-feed lubricator, as the graphite will soon clog the feed passages. For use in engine bearings, a mixture of a heaping teaspoonful of graphite to a pint of oil is sufficient. About 4% by weight is the average good practice when mixed with oils and greases, and gives good results when applied at reasonable long periods. Graphite should never be used on bearings supplied with forced or flooded continuous lubrication.

There are a great variety of lubricating greases. Petroleum cup grease consists of lime soaps, mineral greases and resin oils. Soap gives the grease melting-point and body. Greases are excellent lubricants when properly used, but they have a very narrow range of service and should not be called upon to perform the function of lubrication under conditions to which they are not suited. The use of any solidified lubricant places a drag or friction on the bearing in which it is used. The chief advantage of grease as a lubricant lies in its cleanliness, and in its property to stay put. In bearings revolving at a slow speed, where it would be difficult to maintain a film of lubricant, grease may be used to advantage. For crank-pin bearings of high-speed engines, grease will give satisfactory results. Due to its adhesiveness, it will maintain a layer of lubricant when the machine is at rest, and thus reduce the starting friction when the machine is placed in operation.

The Testing of Lubricants.

While it is possible to lay out quite elaborate specifications for lubricants, covering every type of service, the fact nevertheless remains that these specifications are, after all, only a starting point. After a particular lubricant has been chosen by specification, it remains to test it out under actual working conditions and then to try other lubricants of such a general nature as to lead the engineer to believe that success might attend their use. Only by comparing the performance of a number of lubricants under actual working conditions, can the best lubricant be chosen for the particular service under consideration. The first step, however, is to choose intelligently several lubricants which are to be tested out. In order to do this it may be well to review the tests and specifications used by large consumers in the purchase of lubricants. Chemical, physical and practical tests are made in the complete examination of an oil for a particular service.

Chemical Tests of Lubricating Oils.

To pass the chemical tests of the Navy Department, "all oils should be neutral in reaction, and should not show the presence of moisture, matter insoluble in petroleum ether (hard asphalt), matter insoluble in ether alcohol (soft asphalt), free sulphur, charring or wax-like constituents, naphthenic acids, sulphonated oils, soap, resin or tarry constituents, the presence of which indicates adulteration or lack of proper refining. Except in oil for engines without forced lubrication, no traces of fixed oils (animal or vegetable fats) should be found.

"In lubricating oil for main engines without forced lubrication, approved fixed oils such as rapeseed, olive, tallow, lard and neatsfoot oil may be used. When the foregoing fixed oils are used, they must be well refined with alkalies, unadulterated, containing a minimum of free fatty acids, with no moisture or gummy constituents. Olive oil should not have a high specific gravity. If satisfactory emulsifying results can be obtained with straight mineral oils on engines without forced lubrication, they may be submitted for service test."

While the small plant owner is not usually in a position to have various tests of oils made in his plant, he can have them made by a commercial laboratory at a cost which, in view of the possible savings to be effected, is well worth the time and expense involved. Large plants, of course, often possess laboratories and are in a position to make the tests themselves. The procedure involved in a satisfactory test may be outlined as follows:

Moisture Test.—Wet the walls of one test tube with the oil under investigation and put 3 or 4 cc. of the oil in a second tube and place in a bath of liquid paraffin, which should be brought up to a temperature of 300 deg. F. If the oil contains water, emulsions will form on the walls and foaming and sputtering will be noted.

Sulphur Test.—Take a small piece of metallic sodium the size of the little finger nail and boil it for 30 min. in 50 cc. of the oil in a test tube. At the end of this time add an equal amount of water and again place over the burner flame until the sodium is dissolved. After the sodium has disappeared, pour off the water and pour in a 1% solution of sodium nitroprusside. If the mixture turns to a violet color the oil contains sulphur.

Tests for Acid and Alkalies.—Pour 25 cc. of oil and 50 cc. of distilled water into a test tube and divide the mixture into two equal parts. Add methyl-orange to one part to determine the presence of acids and add phenolphthalein to the other part to determine the presence of alkalies. The formation of emulsions indicates the presence of acids or alkalies as the case may be. Acids cause corrosion and should be avoided in all cases.

Tests for Matter Insoluble in Ether.—Place 14 cc. of ether alcohol (eight parts of ether and six parts of alcohol) and 11 cc. of oil in a test

tube, shake thoroughly for a minute or two and then allow the mixture to stand for 12 hrs. At the end of that time, if there is any precipitation at the bottom of the tube, it will be asphalt. Even a trace of asphalt makes the lubricant undesirable, since it causes scoring of journals and clogging of oil lines.

Tests for Matter Insoluble in High Grade Gasoline.—Filter thoroughly 300 cc. of 86 to 88 Baume gasoline and place it in an absolutely clean and dust-proof glass receptacle. Sprinkle 2 cc. of oil into the gasoline and allow the mixture to stand for 12 hrs. If there is any precipitate at the end of that time, it will consist of soft asphalt or carbon particles, and even a slight trace would make the oil extremely undesirable for use.

Test for Tarry or Suspended Matter.—This test is carried out in the same manner as the previous one, using, however, 95 cc. of gasoline and 5 cc. of oil. The receptacle may be examined for the presence of precipitate at the end of an hour.

Test to Determine Mineral or Vegetable Oils.—Take a small piece of metallic sodium and bring it to a boil in 10 cc. of oil. The presence of animal or vegetable oils will be indicated if the mixture become gelatinized or of a semi-solid nature.

Test for Presence of Undesirable Carbon or Hydro-Carbon.—This test is made by simply heating a small quantity of oil to a boil in a test tube and then comparing the color of the heated with that of unheated oil. If there is any discoloration it indicates the presence of undesirable constituents.

Gumming Test.—This test indicates the extent to which the oil has been refined and will, therefore, serve as a guide to indicate the extent to which oil may be expected to oxidize or gum when in use. The test is undoubtedly of great value and should always be made when opportunity is afforded. It consists simply of mixing a small quantity of oil in the test tube with an equal quantity of nitrosulphuric acid. If the oil has been properly refined, no change will be noted, but if the oil has been poorly refined the fact will become evident by the simple separation of material of dark color. This separation is the result of oxidation of tarry matter in the lubricant.

It has been found that the result obtained by the gumming tests compares almost exactly with what is known as the carbon residue test, which is made by distilling the oil to dryness in the test tube. This carbon test has been found of great assistance in choosing a satisfactory cylinder lubricant for gas engines, as the presence of carbon always and invariably means trouble in gas engine cylinders.

Tests which have just been outlined are easily within the range of even the small plant operator, and the writer believes that the investigation of the characteristics of the oils being used is well worth the attention of operators in both large and small plants.

This is particularly true because of the fact that the presence of undesirable matter in the oils may mean very heavy costs for repairs to equipment and may even cause a shutdown of the plant at critical moments.

SAYS OPERATING DIFFICULTIES ARE ON THE MEND.

Central-Station Executive Makes Statement That Situation in Regard to Money, Coal, Material and Labor Supply Will Be Relieved.

These are troublesome days for the officers and directors of any public utility, writes Alex Dow, president of the Detroit Edison Co., in that company's publication, the *Synchroscope*. The Detroit Edison Co., he says, is not alone among public utilities in that respect, but its operating troubles, with one exception, are definitely mending, although slowly. The exception is that the supply of coal is still exceedingly uncertain.

The question of coal or no coal is the question of railroad movement or railroad paralysis. Paralysis, partial or complete, is the lot of every railroad these days, and the end is not yet. At this time the Detroit Edison Co. is better off for coal than it has been since the coal miners' strike of November and December last. During this summer and autumn we are going to stock all the coal we can get our hands on and that we can put in a stock heap without its promptly taking fire.

Most of the other operating difficulties are due to overloads on plants and lines, and the new turbines, boilers and new lines which have gone into commission or will go into commission this summer will be a great relief. Construction is not being checked on work that is immediately required, but much work that is desirable and some that will soon become necessary is being delayed, and for three very good reasons. The first of these is that while money can be secured to pay for construction that same money costs a lot in the present money market. When the government is paying 5.5% on short-time notes (tax exempt), and Liberty bonds (practically tax exempt) are selling on a 5% basis, public utilities with securities that have no exemption of any kind, cannot expect to get cheap money; therefore money should be spent with double care.

The second reason is that the arrival of the necessary material to carry on work is exasperatingly slow and uncertain. Part of the trouble is that raw materials are not reaching the factories that produce the supplies necessary for construction; the other part of the trouble is that factories cannot make shipments of the necessary supplies because of the paralysis of transportation. The third reason is that after the necessary money and materials have been obtained for the construction, far too many men fail to understand that the laborer ought to be worthy of his hire.

When will the deferred work go ahead again? The answer is that it will go ahead when it is possible to proceed with assurance that each project undertaken will not cost more than a reasonable amount and can be completed without unreasonable delay. No time is lost by stopping to catch one's breath, and the work that is going on will meet the requirements of the public. In the meantime conditions must needs get better, because it is impossible for them to get worse.

Research Problems in Electrical Engineering

Classification of Present-Day Considerations in Connection with Broader Aspects of Research in the Electrical Field

By PROF. VLADIMAR KARAPETOFF
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The most natural division of unsolved problems would be according to the types of apparatus; for example, into problems in the design and operation of large turboalternators, improvements in lamps, circuit-breakers for larger currents and higher voltages, etc. Such problems may be multiplied without end, and one could not venture to express a personal opinion upon their relative importance. A somewhat unusual classification is offered in the following for the pending research problems which may be more helpful to those interested only in the broader aspects of research.

Caliber of Investigators.

One division of research problems that seems to be quite essential is based upon the caliber and mental equipment of the investigator himself. There are problems of great practical importance which can and will be solved by the expenditure of a sufficient amount of money and time. Thus, during the war the shortage of certain materials led to a large number of tests on substitutes, and in some cases satisfactory materials were found by men of average ability and education. A large number of such tests, sometimes dignified by the name of research, are being carried on all the time. For example, there are, offered on the market by principal concerns, certain varieties of mica for mixture with lubricating oils, and comparatively simple tests permit determination of the kind best suited to a given purpose without employing men of unusually high caliber.

At the other end of the scale there are researches which require men of exceptional intellectual power and of wide erudition, researches which have baffled the most persistent efforts for many years, and problems which remain unanswered in spite of the most alluring financial inducements. A reliable high-tension insulator and a simple variable-speed a-c. motor may be mentioned as two such examples. In between these extremes there are innumerable gradations of mental caliber required for the solution of different kinds of research problems, and a clear realization of this fact is of utmost importance in the cultural development of the country. The tendency is to lay too much stress on material resources, equipment and other external factors. A few men of superior caliber and thorough training will accomplish results on which thousands of less gifted and not so thoroughly trained investigators may work for many years without much progress.

The necessity for better care of persons of exceptional scientific intellect is so urgent that it is legitimate to ask what our government, leaders of industry, educational institutions, or any other agencies are doing in this direction. The answer is: "Next to nothing." Moreover, in this imperfect world of ours it is no one's particular business to attend to the proper development of geniuses.

By this is not meant a somewhat utopian scheme of breeding a race of intellectual giants by careful mating, but a perfectly feasible scheme of detecting exceptional children by suitable mental tests and then guiding them year after year to the full development of their mental powers. This is a proper function of the state and some day will become a reality.

Pure and Applied Research.

Another classification of research problems is in accordance with their proximity to or remoteness from the direct industrial applications. A certain physical phenomenon, a mathematical formula, a peculiar alloy, etc., may up to a certain time possess no practical importance and be merely a subject of personal interest to a few investigators. Then one day someone discovers that that particular alloy or formula offers great practical possibilities and it becomes the subject of extensive industrial researches.

While such a state of affairs may seem perfectly natural and unavoidable, it has certain serious drawbacks for the best development of the art. The electrical industry owes many of its triumphs to so-called pure physical research, but until recently this industry offered little encouragement to such research or to its exponents. Had the leaders of the electrical industry realized earlier the tremendous possibilities of physical research in improving commercial apparatus, then instead of sneering at "doctors" they would have used their talent long ago, and we would have been much further advanced in the applications of electricity than we we are now.

But it may be retorted, the scope of physics is infinite, and how can an industrial concern keep on sinking hundreds of thousands of dollars year after year on the mere possibility that some of the results of physical research may at some time prove to be of use to it. The real situation is this: Physical, chemical, or mathematical research involves, first of all, a method of approach, a method of attack of a certain group of related problems, based on a thorough familiarity with the resources of that particular science. Promotion of research, therefore, consists primarily in the encouragement of the

study and further development of such methods and not in the acquisition of a large number of unrelated facts. A scientist trained, say, in alternating currents will be prepared to approach a new problem in this field with much better chance of success than one who has had merely general practical experience and beats about the bush in an effort to discover a short-cut by luck.

Thus the promotion of pure research is another national problem and the first aim must be the training in the methods of analysis, general laboratory methods, the ability to find what is already known, the use of mathematics, the use of methods borrowed from other branches of science, general accuracy of measurements, of computations, of statements, and last though not least, that loving attitude towards nature and the intuition that comes only from a first-hand contact and observation of actual physical phenomena without any preconceived theory or utilitarian thought.

In the early development of our industry we sneered at all research. Then we called it plain testing research. Later we grudgingly tolerated industrial research; that is, an investigation of a particular piece of apparatus in its complexity. Finally, it began to dawn upon some of us that an investigation of the very physical elements which enter into that particular piece of apparatus may lead to interesting discoveries. In this way it gradually became clear that a thorough investigation of the physical laws governing this or that branch of industry may be the quickest and the surest way toward remedying the difficulties in the operation and construction of certain pieces of apparatus. It would not be surprising if in a few years we should make a fad of pure research in industrial establishments and overdo it as we overdid safety and efficiency and patriotism and many other good things.

Experimental and Theoretical Research.

The next division of research problems is into experimental, mathematical, inventive, critical, indicative of new fields, etc. A clear understanding of this division on the part of investigators themselves and of their business managers will help scientific progress materially, in that it will allow each one to apply his effort, imagination and inspiration where it will bear the best fruit, and it will enable two or more investigators to combine their efforts without jealousy or duplication.

Almost any big research problem involves some theoretical study as well as experimental skill, inventive ability and patient search for the work of other investigators and its critical analysis. Only a very few investigators possess all these accomplishments to the same degree, and it is in the hands of a harmoniously organized group of scientific workers of different talents that research leads to gratifying results.

A chain is strong only as its weakest link. Many a research worker struggled in vain with a problem for which he was eminently fitted, just because he failed to recognize the one weak link in himself or was too proud to ask for help on some particular point of difficulty.

The Anglo-Saxon race is individualistically inclined perhaps to a greater degree than the other civilized races. The Americans among the Anglo-Saxons are especially prone to exhibit the western pioneer spirit in research, with all its virtues and shortcomings, of which the utter disregard of the work of preceding investigators is perhaps the most characteristic one.

It is not meant to imply for an instant that an original thinker should be hampered in the flight of his fancy by laboratory assistants or by skilled mediocrities, in the name of a misapplied principle of co-operation. Two other things are meant. First, to clear a big idea in his mind, he ought to know how to let go of it and allow his assistants to play with it for a while and see how it shapes itself in detail. Secondly, if in the preliminary molding of his ideas he should be handicapped by his lack of mathematical ability or of foreign languages (two handicaps common in this country) let him not try to solve the problem in an imperfect manner alone without first having exhausted the possibilities of associating with other gifted and congenial minds who may furnish the missing needs of the problem.

An outsider and often a manager thinks that research men specialize by subject, so that one knows all about d-c. machines, another all about transformers, etc. While to some extent this is true yet there is a much more thorough-going and desirable specialization according to the nature of the man's talent. One is especially gifted in arranging ingenious methods for accurately measuring difficult quantities, whether it be in a-c. or d-c. machinery, another can skillfully present a phenomenon or a relationship in a mathematical form, a third is paticularly adept in finding out quickly and accurately all the preceding contributions on the subject and in assigning the proper relative value or trustworthiness to each.

A student of the history of science can easily recall cases in which a scientific idea is born in one country and then is taken up by someone in another country and finally brought to a fruitful development in a third country.

Perhaps the best known example in our line is that of Hertz, a German, who acted as an intermediary between Maxwell, an Englishman, and Marconi, an Italian. A biologist could easily get examples of living organisms which have to live under different conditions at the various stages of their development. Thus the rust of wheat must live on barberry before it can live on wheat. In this country, with its polyglot population, we have had an exceptional opportunity to observe and to benefit by this co-operation right in our midst, even though in our Anglo-Saxon arrogance we are apt to look down upon our brothers from across the seas. There is hardly an organized institution for research in this country that cannot point to benefits derived from associates of foreign birth and training and point of view.

While first-class original investigators are born and not made, yet there is a great problem before our leaders in politics, industry and education, to facilitate the work of such men by granting favorable conditions for their creative activity. We ought to do this for our sake and for that of the coming generations.

Removing Boiler and Stack Soot With a Steam Jet

Construction and Operation Features of Steam-Jet Conveyor, Similar to Steam Ash Conveyor, for the Disposal of Soot From the Bottom of Stacks, Rear of Boilers and From Economizers

By GUY S. HAMILTON
American Steam Conveyor Corporation, Chicago.

Various methods are employed in the removal of soot from boiler tubes, but after the soot has fallen to the combustion chamber it is often neglected. In this chamber is also found a light ash, known as combustion ash, which has been blown over the bridge wall from the grates. Both soot and combustion ash must be removed at

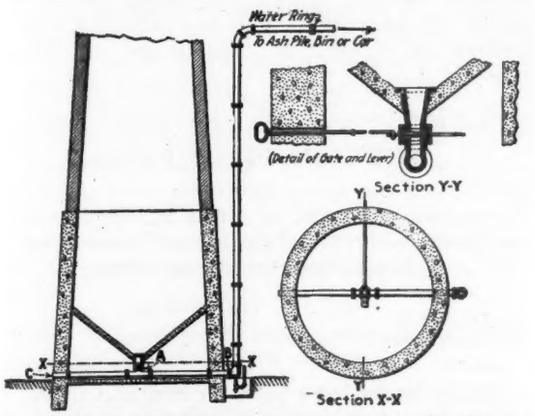

Fig. 1.—Steam-Jet Soot Conveyor Applied to the Bottom of a Smoke Stack.

regular intervals if the boiler is to function properly. If the soot and combustion ash are allowed to accumulate, burned tubes and drums sometimes result. Soot also accumulates at the base of the stack, breeching, smoke up-takes and economizers. Here again, due to its lightness and difficulty in handling, it causes trouble.

Many central-station companies are using the steam-jet conveyor to handle soot, combustion ashes and coal siftings. Their engineers have found that the conveyor solves the problem in an economical and efficient manner. The operation of this conveyor is based on the same principle used in the disposal of ashes by the steam-jet method. Its application depends largely on the location of the conveyor and the duty it is to perform.

When soot is to be removed from the base of a stack or chimney, the steam-jet conveyor is installed with a suction line under the bottom of the stack and a discharge line into the ash bin or pit. A typical installation is shown in Fig. 1. A hopper bottom is built in the existing stack and has an opening in the bottom, under which is placed a specially designed intake fitting, *A*, with a machined box and slide making an air-tight gate. The gate is operated by a rod and lever from the outside of the chimney wall, as illustrated in the detail. At an angle in the conveyor line *B* there is a steam unit through which a high-velocity jet of steam is introduced into the conveyor system. The discharge of this steam is controlled by a steam valve in the usual manner. The upper bend of the conveyor line consists of a long-radius elbow which prevents possible clogging or packing of the fine soot in passing the turn in the conveyor line. At the end of the discharge line is placed a water-spray ring to allay the dust as it is discharged from the conveyor line. If the conveyor discharges into a bin a wash-vent of proper design is used to insure dustless operation.

The operation of the conveyor is simple. The steam and water valves are opened to allow the jet of steam to enter the conveyor line, and allow water to enter the line leading to the

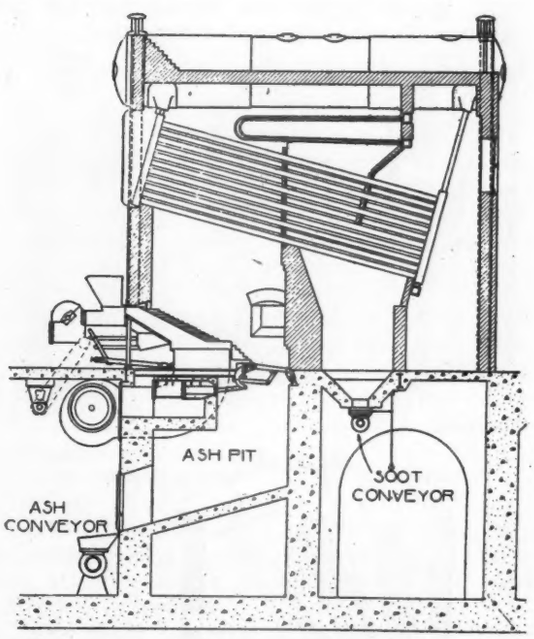

Fig. 2.—This Combustion Chamber Has a Direct Outlet Into a Soot Conveyor.

spray. Then the slide gate is opened and the soot flows by gravity into the intake opening. The entrance of the steam into the conveyor line creates a suction in the line of such force that the soot is carried by it to the steam-unit fitting and, hence, by direct force, through the discharge line.

Inspection doors or peek holes above the hopper are unnecessary because the conveyor may be controlled by sound. When the steam is

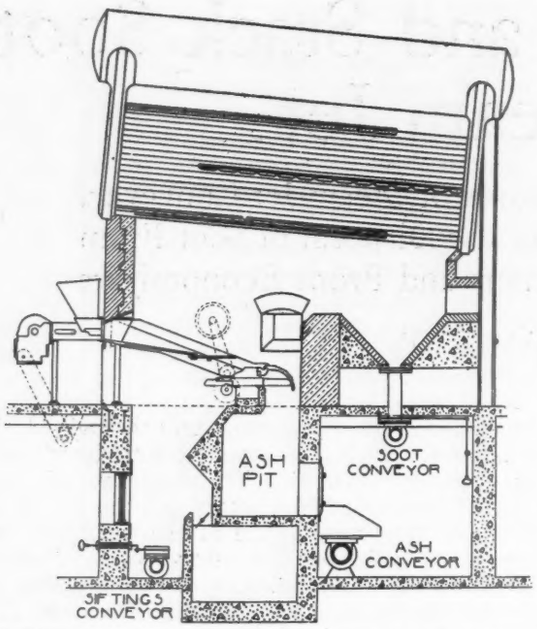

Fig. 3.—One Steam-Jet Conveyor Handles Coal Siftings, and Another One Handles Soot in This Layout.

turned on and the conveyor is running empty, there is a roaring noise as the air rushes into the inlet *C*. As soon as the gate *A* is opened and the material begins to flow into the conveyor, the sound dies out and does not reappear until the bottom of the stack is empty. When the roar begins again, the operator should close the gate and turn off the steam and water valves.

Steam-Jet Ash Conveyor Not Suitable for Soot.

The usual steam-jet conveyor used for the disposal of ashes and cinders will not work successfully in removing soot from the stack base. Soot, compared to ashes, is very fine and flaky and is without any real body or surface. A much higher velocity of the air is, therefore, required to move this material. This higher velocity is practically impossible in the large-diameter pipes used for handling ashes and clinkers. Usually a 4-in. conveyor line is specified, although under certain conditions a 6-in. line is more desirable.

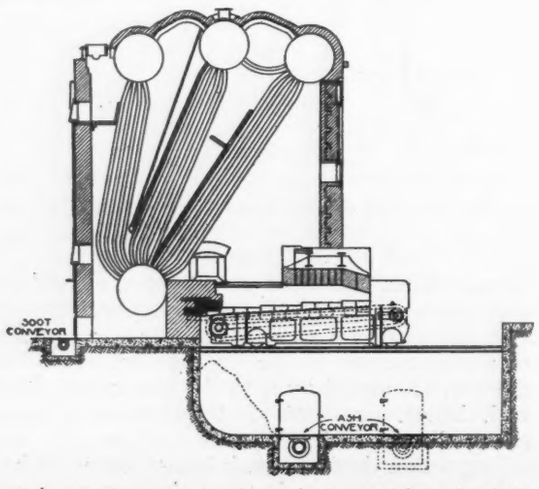

Fig. 4.—Layout Where Soot Is Handled by a Conveyor Outside of the Combustion Chamber.

Fig. 2 shows a soot conveyor as used to handle combustion ash. A hopper construction similar to that previously described is used in this application. An operating lever is so attached to the slide that it can be easily operated from beneath.

In Fig. 3 will be noted not only a soot conveyor for the handling of combustion ash, but also a conveyor for handling coal siftings which may drop from the stoker overhead. In both cases the soot feeds into the intake automatically after the steam has been turned on and the slide pulled to one side.

Fig. 4 shows a slightly different arrangement for handling soot and ash from the combustion chamber. Instead of having the hopper-bottomed arrangements with a slide for controlling the flow of the soot, the intake of the conveyor is located just outside the walls of the boiler. When the fireman cleans the combustion chambers he opens a small door and rakes the soot and ash into the intake, from which it is carried away in the usual manner.

Steam-jet conveyors have been installed in a number of the largest central-station power plants in the country and are handling soot or combustion ashes in an efficient and satisfactory manner.

DEPRECIATION RATES FOR PUBLIC SERVICE PROPERTIES.

Discussion on Means of Reducing Depreciation—Factors Affecting Selection of Depreciation Rates—Question Complicated.

By J. C. Henriques,

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Many books have been written and much discussion has been carried on over the question of depreciation rates for public utility properties. Accounting practice recognizes two general methods of applying depreciation, one by applying a constant annual percentage on the original cost of the property and the other by applying a constant or variable annual percentage on the present or depreciated value. The first has the advantage of simplicity and of providing a uniform coefficient to apply to the cost of the output, or service rendered. The second has the advantage of greater precision, representing the actual sale value of the property at any given time, and provides for writing off, if desired, a large proportion of the cost of equipment in the first few years, this representing the great decrease in value as the article purchased new becomes an item of used or second-hand equipment.

With regard to the properties of public utilities, from a general survey of existing opinions, it appears that the majority of state commissions have proceeded along the straight-line method; that is, the probable life of the properties or building is assumed and an annual sum is set aside sufficient to take care of the accrued depreciation. The annual depreciation charge is set up in a depreciation account or reserve fund.

The writer has appraised a number of public utility plants and has observed a large number of buildings and items of equipment in use that have far outlived the original expectation. Pub-

lic utility commissions have not usually been accused of being too generous toward the private owners of public service plants, yet they have in many cases assumed a depreciation rate based on an expected period of usefulness much shorter than has actually been attained. The increased useful life of the buildings or equipment is in most cases due to an excellent system of continuous and careful upkeep. In fact, it is safe to say that in most public service plants depreciation due to wear and tear can be reduced practically to zero by a liberal expenditure for repairs and maintenance. Even the obsolescence factor is often found by experience with all the properties of a public service plant to be extremely small. For instance, in one central-station plant the company was found to be operating several 100-kw., three-phase rotary converters at 125 volts direct current, which were being used as balancers and rendering valuable service as such.

In the case of buildings used for power plants, gas works, etc., if these are painted periodically and kept in good repair throughout the physical depreciation is very little. The only items which are really important in fixing a depreciation rate are the condition of the buildings with regard to their maintenance in good order, and that proportion of the obsolescence factor due to inadequacy of the buildings for the increased business of the plant or by changes in the art, causing the production of newer and better machinery.

The present percentage rates of depreciation used by public service commissions are as follows:

	Depreciation per year, %
General structures	2 to 4
Power-plant buildings	2 to 4
Steam engines and generators	5
Accessory electric power-plant equipment.	5
Substation buildings	2 to 4
Substation equipment	5
Poles and fixtures	8⅓
Transmission system	5
Transformers	5
Meters of all kinds	5½ to 8⅓

In selecting depreciation rates for any plant it is necessary to take into account the condition of the plant as affecting its value at the time the depreciation rates are put in operation. If the plant is taken at its new value at the date of construction the present value will be obtained by applying a percentage rate equal to the annual depreciation rate multiplied by the number of years since the building or equipment was new. If, on the other hand, the present value of the building is obtained by appraisal, the depreciation rate should be set higher because of the fact that the building is no longer new. At present, with the recent rapid increase in all values, an item of equipment may be worth considerable more than it was when new, and with the probability of the greater decrease in prices during the coming few years the depreciation rate may well be set considerably higher than warranted by the expected life of the building or equipment, so as to give a true value to the property during the years of decreasing prices.

The whole question of depreciation in the present period of time is extremely complicated. Only a competent engineer thoroughly familiar with construction costs of today, as well as with operating expenses, maintenance requirements and the details of use of the equipment, should be permitted to set depreciation rates for buildings or apparatus on the basis of present-day values. The approved principles of depreciation as given by standard publications accepted by accountants as authoritative are still of great importance in determining property values of public service plants today, but the application of the principles is so complicated by the rapid changes in material and labor costs, land values and by the limits placed on revenues that a wise and conservative valuation of public service plant equipment requires the most careful individual study in each case.

LIGHTNING ARRESTER EMPLOYS OXIDE FILM.

This Arrester May Be Installed in the Open and Requires Only a Small Amount of Attention.

The oxide-film lightning arrester has been developed as the result of a demand for an arrester that would give the same amount of protection as the aluminum-cell arrester, without the necessity of daily charging. This charging consists of connecting the aluminum-cell arrester to the line for short spaces of time each day, in order to renew the nonconducting film on the plates, and has made this arrester impractical of installation in isolated places. The oxide-film arrester does not require daily attendance to insure the maintenance of its protective qualities.

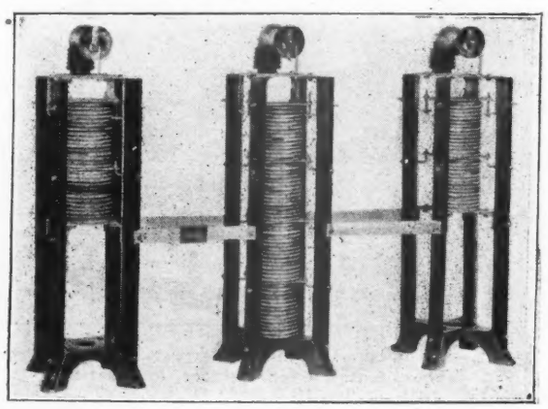


Fig 1.—Oxide-Film Lightning Arrester, Showing Method of Assembling Disk Units and Spark-Gap.

Therefore, although it is practical for almost any application, its principal field seems to be where daily attention is not available, but where good protection is required.

Lately there has been a large increase in the number of isolated stations and substations, this class of service calling for highly reliable protection, and it is here that the oxide-film arrester finds its usefulness.

The construction of this arrester, which is manufactured by the General Electric Co., Schenectady, N. Y., is quite simple, consisting of only a stack of cells and a sphere-gap suitably mounted. In the outside type, these cells and sphere-gaps are thoroughly protected from the weather, thus insuring a uniform spark potential under all climatic conditions. The cells themselves consist of two thin steel plates or elec-

trodes spun on a porcelain ring which acts as an insulator, the space of half an inch between units being filled with lead peroxide. The electrodes are further provided with an insulating film of varnish or some similar compound which gives a uniform insulated surface.

The operating principle depends on the fact that lead peroxide, which ordinarily is of low electrical resistance, is unstable at a temperature of about 250 deg. C. and forms a lower oxide of high resistance to electric current. Thus, although its action is thermal instead of electrolytic, it functions in much the same way as an aluminum-cell arrester, by preventing the flow of dynamic current. What actually happens in practice is that, at a voltage of about 300 volts per cell, the insulating film prevents any noticeable amount of electricity from flowing, but as soon as the voltage rises above normal, sufficiently to spark on the gaps, the film is punctured and the lightning goes to ground since it meets very little resistance. When the dynamic current starts to follow, the smallness of the punctures causes great concentration of current

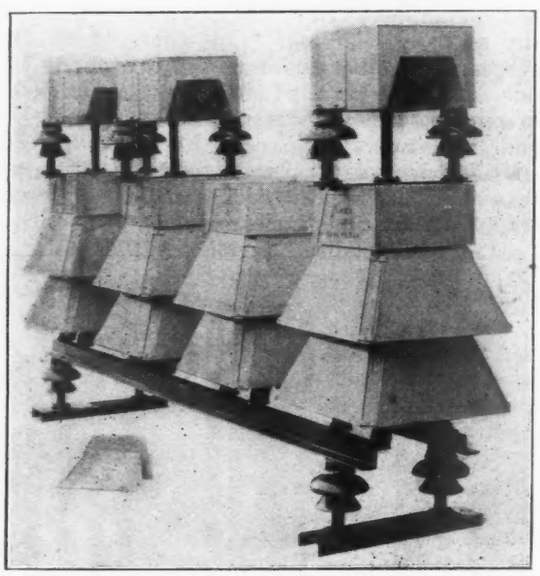


Fig. 2.—Assembly of Lightning Arrester, Showing Protection Suitable for Outdoor Installation.

at those points with a consequent localized heating, which is enough to cause the lead peroxide to break down, thus effectually blocking continuation of the current.

The film reseals itself in about 0.00025 sec. after the excess lightning voltage has ceased. Since the powder is a poor heat conductor, the formation of these high-resistance plugs is confined to the actual area surrounding the puncture. This action being due to the inherent chemical property of the material between the electrodes, there is no action similar to the gradual dissolving of the film which takes place in the aluminum arrester, but it is in a sense permanent, requiring no daily charging.

An installation of these arresters consists of a stack with a sphere spark-gap in series. The illustration, Fig. 1, shows a typical arrester assembled for indoor use on a three-phase circuit of not over 15,000 volts. Fig. 2 gives an idea of the method of protection for outdoor service.

LONG RUN REPORTED ON STOKER-FIRED BOILER.

Boiler of 500-Hp. Capacity Is Operated Five Months Without Cleaning and Without Interruption of Any Kind.

Continuous operation of boiler equipment is much to be desired if there is demand for the capacity and if the boilers can be operated for long periods without fouling either internally or externally. Tons of fuel are required to heat up a boiler in preparation to placing it in service after a shut-down period, and all of this heat is lost in cooling down at the next stopping period.

A story of a remarkably long run on a 500-hp. Stirling boiler is told in a recent issue of *Combustion*. This boiler, which is located in the plant of the Seaboard By-Product Co., Jersey City, New Jersey, is equipped with a superheater and fired by a Coxe stoker 9 ft. 9 in. wide by 13 ft. long. Air is supplied to the furnace by two 22-in. Coppus blowers located at the entrance of the stoker windboxes and controlled by hand. Coke breeze, having about 18% ash and being produced in the Seaboard plant, was used as fuel for this installation. The feedwater temperature was around 200 deg. F., and a boiler pressure of 150 lbs. per sq. in. was maintained.

The stoker equipment for this boiler was completed on Oct. 15 and a light drying fire was started at once and maintained for 72 hrs. Then the stoker equipment was carefully examined, lubricated and run for 48 hrs. to wear in all parts thoroughly. A coat of graphite was then applied to the inside of the boiler drums to prevent the accumulation of scale. Following this, a fire was started and the boiler cut into the line on Nov. 1 continuing in service until April 2, a period of five months. The boiler was shut down at this time for insurance inspection, which inspection was passed without repairs being required.

During this long run the average thickness of the fire was 5 ins., and the grate speed was approximately 22 ft. per hr. About 40 tons of fuel was burned per day to develop an output of 800 hp., or 160% of boiler rating. Outside soot and scale deposits were cleaned from the boiler tubes several times a day throughout the run, using hand cleaners and steam jets. Flue-gas temperatures were about 580 deg. F., and the gas analysis showed an average of about 9% CO_2. Evaporation was at the rate of 6 lbs. of water per pound of coke breeze.

PITTSBURGH ELECTRICAL MEN TO HOLD MEETING.

To obtain a closer working agreement between the electrical contractor-dealers, jobbers, central-station companies and manufacturers of western Pennsylvania, a "get-together" meeting will be held at the Fort Pitt Hotel, Pittsburgh, June 23, William L. Goodwin, Samuel Adams Chase, M. C. Turpin and Harry B. Kirkland being the principal speakers. This meeting will be held in connection with the Pennsylvania State Association of Electrical Contractors and Dealers, which will meet in Pittsburgh June 24-26.

EDITORIAL COMMENT

Basing Rates on Reproduction Plant Value

In the recent decision of the United States Supreme Court upholding the "reproduction new" as the basis for fixing railroad rates is seen the possibility of rate increases of nearly 100% for all public utility operators. The decision was made in the case of the Kansas City Southern railroad against the Interstate Commerce Commission.

According to press dispatches, the Supreme Court held the present value of the physical property of the railroad should be accepted as the basis for determining rates. In most cases the physical properties of electric light and power, gas, street-car, telephone and telegraph, and railroad companies would cost nearly double the original value if reproduced at the present time. Property value is the largest item considered in rate fixing. Other items are operating cost and percentage of profits. From the "reproduction new" value must be deducted the amount of depreciation.

As far as known the point involved in the recent decision has not been brought up by any electric light or power company at any of the numerous hearings held throughout the country on the question of increase in rates. But it has in the case of other public utilities. In fixing the new schedule of rates for the telephone companies operating in Indiana, the public service commission of that state recently refused to accept the "reproduction new" basis offered by the company, but based the new rates on the reproduction values of the companies' various physical properties throughout a period of five years. Many other cases have been decided by the Indiana commission on the same basis.

Conditions similar to those created in Indiana by the basis established by the Supreme Court exist in various other states. Little doubt is entertained by rate experts that the railroad decision will be so far-reaching as to affect every form of industry over which a government institution possesses rate-making authority.

In the Kansas City Southern railroad case the value of the rolling stock was not offered for consideration by the Supreme Court, but the court found for the company's contention on its present-day cost of right-of-way and terminals.

It is difficult to foresee the results of the establishment of the new basis of valuations. As far as rates are concerned, it is quite clear that the "reproduction new" of nearly all utilities would make rates nearly double the present rates if a profit margin of 7% is maintained.

Teaching the Proper Use of Appliances

We still read in the daily papers the accounts of losses attributed to crossed wires, short-circuits, defective insulation and neglect of electrical appliances. Some of these cases are actually as represented, although in many instances ignorance of the origin of a fire leads newspaper reporters to jump to the conclusion that causes were electrical. The oft-repeated accusation engenders in the minds of many a certain reserve in the adoption of new devices and in the application of electrical equipment to new fields of service. This applies not alone to the timid housewife who accepts the electric light and still hesitates at the use of a flatiron, washing machine or warming pad, but also to many users of industrial power.

Education is the only agency by which timidity or actual fear can be banished. The answer, then, is to educate the public, and to accomplish this requires constantly applied effort directed towards a specific end. During the past years we have learned the word propaganda and its meaning. It fits the case exactly. After a long period of effort the general public has been taught to want the many services that can be received through the simple means of attaching a cord to a lighting socket, but still the service actually received in this manner is only a fraction of the service that is desired and that should be had. The organization is ready, the plants and lines are ready, the houses and shops are wired and ready and the customer is paying for this readiness to serve, but still hesitates to step over the line and use the service for which he is already maintaining all the equipment except the last link in the chain that makes the service possible.

In many cases the central-station customer hesitates in the adoption of a new service simply because he does not trust the utilization equipment. As a matter of fact, there are standard wires, switches, sockets, extension cords, connections and appliances that give any customer a wide selection of safe equipment for domestic use; there are motors and power ap-

pliances manufactured to meet practically every type or character of demand that can be made, so that the user of industrial equipment can be served in the existing markets. This being true, it is the duty of the central-station company, the manufacturer and the dealer to complete the cycle by teaching the public that there are safe appliances to give the service desired, then to see that the public gets them, and finally to educate the public as to their proper use. The central-station company should assume its share of the burden of education because it will serve the appliance, will be in touch with the owner at all times and will profit by the sale of each unit that is giving satisfaction and working regularly. The manufacturer who knows his equipment, will profit by the honest presentation of worthy goods, and, hence, is, for selfish motives, bound to take his place in the campaign of education. Every appliance comes from the shelf of a dealer. He is the point of contact between the ultimate consumer and the source of supply. Hence, the dealer is very much interested in the sale of appliances that will stay sold and give satisfaction and create confidence.

How can a campaign of public education be carried through? Let the manufacturers inform the public, the central-station company and the dealer; let the central-station inform the public and the dealer, and let the dealer inform his customers. The dealer should follow each sale with specific information as to both the economic and safe use of the particular device sold. Terse, illustrated leaflets inclosed with monthly bills or with other correspondence can be used by the central-station to inform its customers on points of service, economy and safety. Manufacturers can spread the gospel of proper use of electrical device through the many national publicity industries they employ; would not such propaganda result in profit to the industry and in service to the public?

Wages and Necessities

Prices are, after all, only relative. The matter of wages is of little importance unless the value of necessities is considered simultaneously. That which should interest the man who works is not so much his daily wage in dollars as the amount of the world's goods that the dollar will buy.

Throughout all ages the cost of the necessities of life that a workman in a free country has had to provide has borne a certain relation to the wage that he received. This relation could scarcely be called a ratio because of the fluctuations to which both wages and costs are subject. But a general relation always has existed and, if the statistics issued recently by the government loan organization are correct, the relationship is one steadily in favor of the man who works.

Even in this year of unconscionable profiteering, the relation between the wage for a day's work and the quantity of life's necessities that it will purchase is more favorable than it has been in other centuries. This means that the condition of the man who does the common labor in industry is, generally, improving.

The situation is as it should be, of course, and in no way excuses, the orgy of profiteering in necessities that is flourishing. The profiteer should be dealt with as summarily and effectively as any other criminal since, by diminishing the value of the dollar in terms of quantity of necessities, he is reversing the process of industrial development. But the laborer should realize that his situation is, relatively, much better than that of the laborers who have lived before him.

Railroad Revenues and Operation

Few people do not know that the railroad companies need an increase in revenue. The fact has been mentioned, repeated, proved times without number. Railway executives scarcely have spoken a word during the past year without prefacing it with the statement that the railroads need more revenue. Newspapers also have reminded the public that the railroads cannot, at prevailing rates, continue to render service even with their old equipment, and that the purchase of new equipment is an impossibility.

With the general willingness, however, to see the railroads prosper is coupled the desire to see the managers make the best use of their equipment. No doubt most of them are endeavoring to do so. The members of the Interstate Commerce Commission, also, in each of whom the country has great confidence, are doing their best to make the present equipment function at 100% efficiency. One wonders, however, whether allowing damaged equipment to remain unrepaired or moving trains of empty cars across the continent is in harmony with economical operation. When one who rides along a right-of-way sees these unloaded trains or groups of rusty locomotives standing idle with odd parts missing, it is difficult to believe that the movement of the trains is efficient or that adequate repair work is being done. It seems reasonable to suppose that, when cars are moved, they should be loaded, and that, when cars and locomotives are damaged or in bad repair, they should be repaired with dispatch if the best use is to be made of equipment. However, the roads do need new equipment and their present revenue is inadequate. They should receive as much increase as the Interstate Commerce Commission in its wisdom deems advisable.

CURRENT EVENTS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

UTILITIES AND THE PUBLIC HAVE COMMUNITY OF INTEREST.

This Fact Is Emphasized in Telegraphic Report of First Session of Convention of North Central Electric Association.

That utilities play a vital part in industrial and civic growth and that the public should be educated to understand the utility companies' viewpoint in service was brought out in the opening session of the two-day convention of the North Central Electric Association at Minneapolis, Minn., June 16. The association is composed of the states of Minnesota, North Dakota and South Dakota and forms a geographic division of the National Electric Light Association.

The sincerity of the purposes of the public utility companies was the keynote of the convention and was brought out by Henry D. Thrall, vice-president of the Minnesota Loan & Trust Co., and by M. H. Aylesworth, executive manager of the National Electric Light Association, who were the principal speakers at the first day sessions.

Mr. Thrall delivered an able address on the trend of the financial situation as it affects the utility market and made an analysis of present market conditions. He declared that the most practical method of financing the sale of securities was through the plan of local ownership and that this would result in the future of utilities being in the hands of the people in the territory served and that the developmen of the utilities would then parallel that of the communities in which they operate. Education of the people was necessary to obtain this result, the speaker said.

Mr. Aylesworth spoke of the protection now being given utilities by public service commissions, citing from the addresses made by Carl Jackson, president of the Wisconsin Railroad Commission, and E. O. Edgerton, president of the California Railroad Commission, at the recent Pasadena convention. Utilities, in most instances, are now being given fair treatment, Mr. Aylesworth pointed out, and the public is being awakened to the very important fact that utilities hold the solution of the industrial growth of the communities in which they serve. More education of the public as to the utility business was necessary, he said. Mr. Aylesworth outlined the purpose of the geographic section of the N. E. L. A. and also told of the work being performed by the committees on public utility information, now in operation in several states. He also told of the future plans of the N. E. L. A. headquarters, outlining the work to be performed by the staff.

F. R. Winders of the Wisconsin Railroad Commission spoke on rural electric lines and discussed the rules that should govern the operation of such lines. Considerable discussion followed the address as to the practices of different companies in handling rural line extensions.

At the Thursday session "The Fuel Situation" was discussed by M. H. Groverman, secretary of the Northwest Coal Dock Operators' Association; "The Transportation System in the Northwest," by W. P. Trickett, general manager of the Minneapolis Traffic Association, and "Present-Day Conditions and Tendencies in the Development of Domestic Electric Cooking," by H. A. Dahl and Miss Bernice Bell of the electric cooking bureau of the Minneapolis General Electric Co. A report of the closing sessions will be given in next week's issue.

ARRANGE PACIFIC COAST, A. I. E. E., MEETING PROGRAM.

Many Papers Are Listed for Presentation at Ninth Annual Convention to Be Held in Portland, Ore., July 21-24.

The Portland (Ore.) Section of the American Institute of Electrical Engineers will be the host at the ninth annual Pacific Coast convention of the institute to be held in Portland, July 21-24, with headquarters at the Multonomah Hotel.

Under the tentative program arranged the convention will be opened with an address by Calvert Townley, president of the institute. The following papers will be presented at the convention: "Factors Controlling the Design and Selection of Suspension Insulators," by W. D. A. Peaslee, electrical engineer of the Jeffrey-Dewitt Insulator Co.; "Electrical Characteristics of the Suspension Insulator at the Higher Voltages," by F. W. Peek, Jr., consulting engineer of the General Electric Co., Pittsfield, Mass.; "Unit Voltage Duties in Long Suspension Insulator Strings," by Harris J. Ryan and H. H. Henline, of Leland Stanford University, Stanford, Cal.; "Electrification of Railroads," by Reinier Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul railroad; "Bridge Methods for A-C. Measurements," by D. I. Cone, engineering department of the Pacific Telephone & Telegraph Co.; "Sawmill Refuse, Fuel Oil and Pulverized Coal," by Darrah Corbet, of Charles C. Moore & Co.; "Power-Factor Correction on Distribution Systems," by D. M. Jones of the General Electric Co., Schenectady, N. Y.; "Use of Special Steels in Pressed Steel Transmission Line Fittings," by L. R. O'Neill, chief engineer of the Maryland Pressed Steel Co.

The entertainment program of the convention will consist of automobile tours through Portland and suburbs, a golf tournament for the John B. Fisken cup and a trip over the Columbia River highway, followed by a dinner at the

Crown Point Chalet on Friday. Saturday, July 23, will be devoted to tours of inspection through the steam and hydroelectric plants of the Portland Railway, Light & Power Co. and the Northwestern Electric Co.

UNDERWRITERS' COUNCIL DISCUSSES SAFETY FIRST IDEA.

Electrical Council of Laboratories Also Approves Plan of Extending Accident Rating to Standard Electrical Appliances.

At the last meeting of the electrical council of the Underwriters' Laboratories, attended by electrical engineers from all parts of the country, the main topic of discussion was the relation of the electrical department work of the laboratories as to tests, reports and listings for personal accident hazards, or, in other words, the safety first idea. The council approves the policy of extending to electrical appliances the assignment of an accident rating in addition to a fire rating as rapidly as the development of principles and standards permit.

Pending the establishment of more complete and detailed standards, the recommendation was made that the minimum requirements for enclosed switches include: first, enclosure; second, external operation; third, that circuit connections, which, if properly made, will render fuses "dead" when the switch is open, must be marked unless the design of the switch is such as to make such marking unnecessary.

The problem of regulating the use of portable devices was discussed at some length, but the sense of the meeting was to the effect that no adequate means could be recognized at the present time for control of the use of the socket in connection with portable devices.

A committee was appointed to co-operate with the electrical department staff to investigate and present to manufacturers of fuses and panelboards for consideration the question of establishing a special fuse of 15 amperes capacity for exclusive use on branch lighting circuits.

WESTINGHOUSE COMPANY ELECTS FIVE DIRECTORS.

At the annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Co., held at East Pittsburgh, Pa., June 9, the following directors were unanimously re-elected for three years: Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., New York City; Joseph Marsh, president of the Standard Underground Cable Co., Pittsburgh, Pa.; H. H. Westinghouse, chairman of the board of the Westinghouse Air Brake Co., New York City; Albert H. Wiggin, chairman of the board of the Chase National Bank of New York City.

George W. Davison, president of the Central Union Trust Co. of New York City, who was selected by the board of directors to succeed James N. Wallace, deceased, was elected by the stockholders for the term expiring June, 1921.

The election was decided by the largest number of votes ever cast in the history of the company.

WILL DISCUSS MANY SUBJECTS AT A. I. E. E. CONVENTION.

Committee Has Arranged for Long List of Papers to Be Presented at Thirty-sixth Annual Meeting of Institute.

Papers on subjects of vital interest to all branches of the electrical industry will be presented and discussed at the thirty-sixth annual convention of the American Institute of Electrical Engineers to be held at White Sulphur Springs, W. Va., June 29-July 2, with headquarters at the Greenbrier Hotel.

The program, as tentatively arranged, calls for 39 papers and reports with the convention divided into seven sessions, covering four days, thus giving the delegates plenty of time for recreation and entertainment. The opening session, Tuesday, June 29, will be devoted to the reading of the address of President Calvert Townley and the reports of the technical committees.

Wednesday will be given over to the electrical machinery section and the miscellaneous section sessions. On Thursday will be held sessions of the protective devices, electric welding and power-factor sections, the convention ending on Friday, July 2, with a session of the excitation section.

The full list of papers as arranged by sections is as follows:

Electrical machinery section.—"Classification of Large Steam Turbogenerator Failures," by Philip Torchio; "Ventilation and Temperature Problems in Large Turbogenerators," by B. G. Lamme; "Temperatures in Large A-C. Generators," by W. G. Forster; "Some Practical Experience with Embedded Temperature Detectors in Large Generators," by C. J. Fecheimer and E. D. Newbury; "Eddy Current Losses in Armature Conductors," by R. E. Gilman.

Miscellaneous section.—"The Corona Voltmeter and the Electrical Strength of Air," by J. B. Whitehead and T. Isshiki; "Reactive Power and Magnetic Energy," by Joseph Slepian;; "Theory of Speed and Power-Factor Control of Large Induction Motors by Neutralized Polyphase A-C. Commutator Machine," by John I. Hull; "High-Tension Insulator Porcelain," by W. D. A. Peaslee.

Protective devices section.—"The Use of Reactors on Large Central-Station Systems," by R. F. Schuchardt; "Stability of High-Power Generating Stations," by C. P. Steinmetz;; "Voltage Stresses in Reactors in Service," by F. H. Kierstead and Royal Meeker; "Calculation of Magnetic Force on Disconnecting Switches," by H. B. Dwight; "Stresses in Conductors Carrying Heavy Currents," by I. W. Gross.

Electric welding section.—"Design of Constant-Current Generators for Arc Welding," by K. L. Hansen; "Automatic Arc-Welding Apparatus," by S. R. Bergman and H. L. Unland; "Arc-Welding Machines of the Wilson Welder & Metals Co.," by Alexander Churchward; "Characteristics and Performance of Arc-Welding Machinery," by A. M. Candy; "Arc-Welding Machinery of the United States Light & Heat Corp.," by W. H. Turbayne; "Recent Develop-

ments in Electro-Percussive Welding," by D. F. Miner.

Power-factor section.—"Power-Factor Improvement Dependent Upon Adequate Metering," by Will Brown; "Power-Factor in Polyphase Systems," by F. B. Silsbee; "Power-Factor and Unbalance on a Polyphase System," by C. J. Fecheimer; "Polyphase Power Representation by Means of Symmetrical Co-ordinates," by C. L. Fortescue; "Measurement of Power-Factor on Unbalanced Polyphase Circuits," by R. D. Evans; "Polyphase Power-Factors and Unbalanced Loads," by Philip Torchio; "Power-Factor in Polyphase Circuits," by W. H. Pratt. There will also be papers on "Polyphase Power-Factors," by F. C. Holtz, H. L. Wallau and P. M. Lincoln.

Excitation section.—"Considerations Which Determine the Selection and General Design on an Exciter System," by J. T. Barron and A. E. Bauhan; "Factors in Excitation Systems of Large Central-Station Steam Plants," by A. A. Meyer and J. W. Parker; "Exciters and Systems of Excitation," by H. R. Summerhayes; "The Application of D-C. Generators to Exciter Service," by C. A. Boddie and F. L. Moon; "Exciter Practice in the Northwest," by J. D. Ross; "General Excitation Practice in the Hydroelectric Plants of the Southern California Edison Co.," by H. H. Cox and H. Michener.

The committee in charge of the convention has arranged that all the section sessions will be held in the mornings, thus giving the institute members and guests ample time for recreation purposes and to enable them to get together and become acquainted. Entertainment, including golf and tennis tournaments, horseback rides and automobile trips, dancing, tea and card parties, has been provided for, and the advance arrangements indicate that nothing has been left undone to make the convention a success both from a business and entertainment standpoint.

S. E. D. WILL CO-OPERATE IN THE CALIFORNIA CAMPAIGN.

Efforts are being made by the officers of the Society for Electrical Development and the California Electrical Co-operative Campaign to co-ordinate the work of those two organizations. The latter is an organization the purpose of which is to promote the use of electricity and electrical apparatus in the State of California by introducing up-to-the-minute methods of salesmanship and by other publicity work. It does locally exactly what the Society for Electrical Development does nationally, but it is unable to share in the national educational publicity that the Society for Electrical Development is doing.

It has occurred to many that the two organizations would be benefitted if they were affiliated. With this idea in view J. M. Wakeman, manager of the Society for Electrical Development, has held several conferences with the officers of the California organization. Unless some unforeseen situation develops, chances for the affiliation are good. The plan as at present contemplated is for the two organizations to co-operate in the broad educational work that is being done by the Society for Electrical Development and for the California organization to continue to conduct its local work.

ILLUMINATING ENGINEERS TO HAVE LARGER INFLUENCE.

Council of Society Broadens Scope of Organization to Permit Establishment of Local Chapters Throughout Country.

At a meeting of the council of the Illuminating Engineering Society held in New York City, June 11, several matters of importance were considered, the principal ones consisting of the confirmation of the election of new officers for the ensuing year and of the adoption of amendments to the constitution, consideration of plans to establish local chapters, and a proposal to arrange a course in illuminating engineering for use in schools.

The proposal to establish a course in illuminating engineering came from the committee on education of the society. A report of this committee shows that it has formulated a definite plan for the course and is already preparing and printing a correspondence and extension course that will be distributed among universities, correspondence schools and other approved agencies for disseminating knowledge. The society will underwrite the course. As a means of meeting the demand for authoritative information on the subject, the council authorized the publication of the third edition of its code of school lighting. This action was taken because of a large number of requests for copies of the code. The requests could not be complied with on account of the fact that the first and second editions are completely exhausted.

Because the constitution has not provided for the creation of local chapters, the growth and influence of the society has been restricted. This disability has been removed, however, by the adoption of an amendment providing for such chapters. An immediate petition from illuminating engineers in San Francisco for the creation of a chapter there to be known as the San Francisco Bay Cities chapter is the result of the constitutional change. The chapter will be the first to be granted a charter under the terms of the modified constitution.

Altogether, five amendments to the constitution were adopted. Their effect has been to provide for student members, to lower the age limit, to increase dues slightly, to provide for local chapters, and to make amendments to the constitution effective on Oct. 1 instead of 20 days after adoption.

Officers whose election was confirmed are, for the national society, Gen. George H. Harries, president; H. F. Wallace, Dr. George S. Crampton and J. J. Kirk, vice-presidents; Clarence L. Law, general secretary; L. B. Marks, treasurer; and Adolph Hertz, Walton Forstall and Frank S. Price, directors.

Those whose election was confirmed for the New York Section are Dr. Ralph E. Myers, chairman; S. W. Van Rensselaer, secretary, and Herman Plant, Charles Franck, Frank R. Barnitz, C. A. Barton and H. V. Bozell, managers; for the New England Section, N. W. Gifford,

chairman, J. T. Kerens, secretary, and J. W. Cowles, F. A. Gallagher, Jr., L. T. Troland, C. M. Halstead and Davis Crownfield, managers; for the Philadelphia Section, C. E. Clewell, chairman, H. B. Anderson, secretary, and Dr. Howard Lyon, G. Bertram Regar, Herman Eckstein, C. S. Snyder and J. B. Kelley, managers; for the Chicago Section, J. L. Stair, chairman, J. J. Kirk, secretary, and F. F. Fowle, J. W. Foster, E. D. Tillson, F. T. Benson and A. T. Hunt, managers.

The membership of the council for 1920-1921 will be as follows:

Gen. George H. Harries, president; Samuel E. Doane and G. H. Stickney, junior past presidents; Clarence L. Law, general secretary; H. F. Wallace, Dr. George S. Crampton and J. J. Kirk, vice-presidents; L. B. Marks, treasurer; and Adolph Hertz, Walton Forstall and Frank S. Price, directors.

Officers will assume their responsibilities on Oct. 1.

CHEMICAL INDUSTRIES WILL HOLD NATIONAL EXPOSITION

What promises to be one of the largest distinctly industrial expositions ever held will be the sixth national exposition of chemical industries that will open at the Grand Central Palace, New York City, on Sept. 20 and continue for one week.

The exposition will be divided into three special sections, one the electric furnace section, another the fuel economy section, and the third a materials handling section. The first, as its name implies, will be one of electric furnace exhibits; the fuel economy section will consist of exhibits of machinery and apparatus, furnaces, producers, stokers, and all devices for the economic utilization or more efficient combustion of fuel.

The materials handling section will consist of a series of exhibits of machinery such as conveying, transporting, elevating, measuring and power transmission equipment. So important have these mechanical features become for all industrial plants, due to the shortage and high wage for man-power, that an unusual interest is expected in this section.

NEW YORK SECTION, I. E. S., MEETS IN CINEMA STUDIO.

For its "ladies' night" meeting, June 17, the New York Section of the Illuminating Engineering Society deserted its own headquarters and held its meeting in the International Cinema Equipment Center, New York City, where a program filled with interesting features in connection with the making of motion pictures was given. The main paper was "Where the Motion Picture and the Illuminating Engineer Meet," by E. L. Bragdon, technical editor of the *Motion Picture News*. The Pathescope Co. of America gave a demonstration of its portable projector using the standard safety film and a demonstration of how Prizma pictures are made was given by the Prizma company. Preceding the meeting an informal dinner was held at Churchill's restaurant.

IOWA SECTION, N. E. L. A., HOLDS CONVENTION NEXT WEEK.

Men, prominent nationally in the electrical industry as well as in Iowa, will be among the speakers at the annual convention of the Iowa Section of the National Electric Light Association, to be held at Colfax, Ia., June 23-25. The convention headquarters will be at the Hotel Colfax. Rex H. Clark of the Des Moines Electric Co. is assistant secretary of the Iowa section.

ENGINEERING ADVERTISERS HEAR TALK ON PHOTO ENGRAVING.

At the June meeting of the Engineering Advertisers' Association at the Hotel La Salle, Chicago, Louis Flader, commissioner of the American Photo Engraving Association, gave a talk on the subject of photo engraving. Mr. Flader introduced his address by a brief historical sketch of the engraving business from the time when pictures crudely drawn on the walls of caves were used to express ideas. This was followed by the invention of type and later the advent of the wood cut.

COMING CONVENTIONS.

Iowa Section of the National Electric Light Association. Annual convention, Colfax, Ia., June 23-25. Assistant Secretary, Rex H. Clark, Des Moines, Ia.

American Institute of Electrical Engineers. Annual convention. White Sulphur Springs, W. Va. June 29-July 2. Headquarters, The Greenbrier. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual convention. Cedar Point, O., July 13-16. Secretary, D. L. Gaskill, Greenville, O.

Pacific Coast Section of the National Electric Light Association. Annual convention, Portland, Ore., July 21-23. Chairman, R. M. Boykin, Portland, Ore.

Michigan Section of the National Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-26. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 8-11. Secretary H. M. Stine, 211 Locust street, Harrisburg, Pa.

New England Section of the National Electric Light Association. Annual convention, Kineo, Me., Sept. 13-16. Secretary, O. A. Bursiel, 149 Tremont street, Boston, Mass.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 4-8. Headquarters, Southern Hotel, Secretary, W. H. Morton, 110 West 40th street, New York City.

PENNSYLVANIA ASSOCIATION WILL MEET IN SEPTEMBER.

The Pennsylvania Electric Association will hold its thirteenth annual convention at Bedford Springs, Pa., Sept. 8-11, with convention headquarters at the Bedford Springs Hotel. M. H. Aylesworth, executive manager of the National Electric Light Association, will be one of the speakers at the convention. The association is a state section of the N. E. L. A. Henry M. Stine, 211 Locust street, Harrisburg, Pa., is the secretary of the association.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

CUSTOMER OWNERSHIP PLAN MEETS FAVOR OF BANKER.

Tells Missouri Utilities Men That Plan Is Big Step in Right Direction for Proper Financing of Companies.

Customer ownership of public utility company securities by persons living in the territory served by a utility company was given hearty approval by C. E. Randall, cashier of the Bank of Commerce, Springfield, Mo., in an interesting talk on that subject at the convention of the Missouri Association of Public Utilities at Jefferson City, Mo., June 3-5.

After referring to the fact than many banks did not look with high favor at this time to the handling of loans or rendering other financial interest to utility companies, Mr. Randall said the time was ripe for a better understanding between the public and public service corporations.

"What is needed," said Mr. Randall, "is a more friendly attitude on the part of the public toward the public service corporations and the latter also need a better understanding as to the needs of the public. One evil, a necessary one, perhaps, is the fact that the stock of most public utility companies is owned outside the territories in which they operate.

"This evil, or condition, can be easily remedied to a great degree through the sale of stock of the utility to persons residing in the territory served by it. I have noticed a growing tendency to do this, not only in Missouri but in all other parts of the country, and it is sure to result in much good.

"A public utility company is part and parcel of the neighborhood in which it operates and as such the persons living in that territory should be financially interested in it. It is a demonstrated fact that once a person becomes financially interested in a public utility company serving his needs he becomes a large and potential asset of good will to the company and becomes a 'booster' where very frequently prior to that time he has been a 'knocker.'

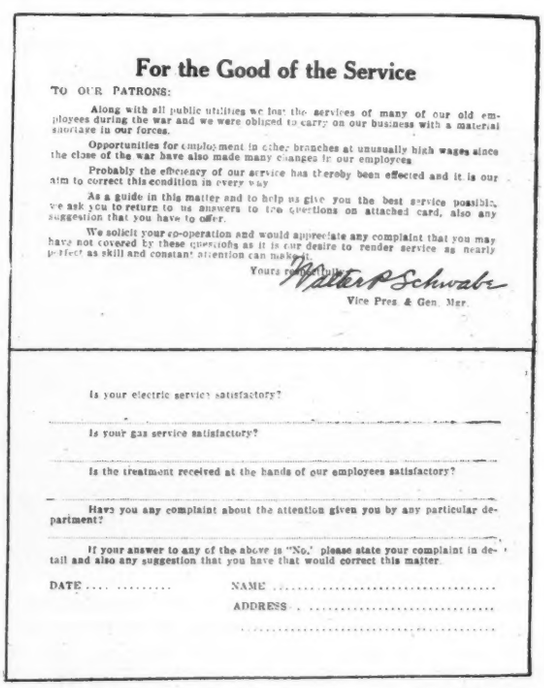
"While the customer ownership plan is a good thing for all companies it is especially helpful to the smaller ones, serving a limited territory, for in such cases all of the people served know the exact conditions confronting the company. Also, while the amount of money obtained by the sale of securities in such territory is small when compared to the needs of a large company it is a distinct and valuable aid in the financing of the smaller companies.

"The sale of securities in this manner will also tend to make it easier for the utility company to arrange loans through the banks in its territory, as the bankers will be in a position to know who the stockholders of the company are and will be far more interested in them than if the stockholders were men located in New York City or elsewhere far from the scene of operations of the company.

"The plan has the added advantage of destroying a feeling that now exists to quite a large extent, that feeling being that some public utility companies now drain one prosperous territory to benefit and improve another where the business of the utility is not as prosperous."

USES POST CARDS IN GOOD-OF-THE-SERVICE CAMPAIGN.

The Northern Connecticut Light & Power Co., Thompsonville, Conn., recently made use of postal cards in a "good of the service" campaign to find out how many customers of the company were satisfied with the service rendered. The company has 5000 customers and the number of cards sent out to cover both gas and electric consumers totalled 3400. Of the total cards sent out 378 were returned. Of this number 98.9% were from satisfied customers and only 1.1% had any complaint to make.



For the Good of the Service

TO OUR PATRONS:

Along with all public utilities we lost the services of many of our old employees during the war and we were obliged to carry on our business with a material shortage in our forces.

Opportunities for employment in other branches at unusually high wages since the close of the war have also made many changes in our employees.

Probably the efficiency of our service has thereby been effected and it is our aim to correct this condition in every way.

As a guide in this matter and to help us give you the best service possible, we ask you to return to us answers to the questions on attached card, also any suggestion that you have to offer.

We solicit your co-operation and would appreciate any complaint that you may have not covered by these questions as it is our desire to render service as nearly perfect as skill and constant attention can make it.

Yours very truly,

Walter P. Schwabe

Vice Pres. & Gen. Mgr.

Is your electric service satisfactory?

Is your gas service satisfactory?

Is the treatment received at the hands of our employees satisfactory?

Have you any complaint about the attention given you by any particular department?

If your answer to any of the above is "No," please state your complaint in detail and also any suggestion that you have that would correct this matter.

DATE ..... NAME .....

ADDRESS .....

Facsimile of Post Card Sent to Customers by Northern Connecticut Light & Power Co.

THE CENTRAL-STATION COMPANY SHOULD CATER TO PUBLIC.

In a paper on "Service," presented at the recent annual convention of the National Electric Light Association, S. M. Kennedy of the Southern California Edison Co., pointed out that

in order to fully analyze the subject of service there are two angles from which service must be considered: first, "on what good service depends," and, second, "what depends on good service." Under the heading, "on what good service depends," Mr. Kennedy discussed rate schedules in the following terms:

It is the business of the good central-station company to cater to the public and anticipate its wishes. Now, if there is one thing a consumer likes to know more than another, it is what his service is costing him and how his bill is figured. For this reason rate schedules of the simplest form are the most desirable. From an engineering standpoint, the so-called scientific schedules, where the rate curve is supposed to follow the cost of service, are interesting, educational and valuable, and such schedules may be used to advantage in handling the larger blocks of lighting, heating and power business. But, for the ordinary man, the smaller consumer, complicated schedules are mystifying and confusing and tend to create the impression that they are framed to conceal the cost rather than to reveal it."

CITY MUST PAY ESTABLISHED RATES FOR SERVICE.

Municipality Stands on Same Footing as Individual or Corporation Rules Idaho Public Utilities Commission.

In a recent case before the Idaho Public Utilities Commission it was ruled that a city has no rights in rate matters other than those applying to individuals or corporations. The decision was made in the case of the Utah Power & Light Co., which had filed with the commission a petition for an order authorizing it to apply to the standby or emergency service furnished by it to the city of Idaho Falls, Ida., the company's scheduled rate for such service.

The city intervened in the hearing and alleged that it is a municipal corporation under the laws of Idaho, that it entered into a contract with the predecessor of the Utah Power & Light Co. by way of a franchise, and that the franchise under which the company operates in the city of Idaho Falls was entered into prior to the passage of the public utilities law, and for that reason the commission has no jurisdiction or authority to permit any change in the rate, or to fix any rate concerning such service, for the reason that any change would in effect vary the terms of the franchise.

The commission ruled that it had no jurisdiction over the city assets nor over any of its acts with regard to its own electric light plant and system within the city, but when the city demands and receives services from a public utility, which, by the public utility law, is within the jurisdiction of the commission, the city stands in no different relation or position than any other patron of such utility.

In stating the reason for the stand taken the report of the commission said: "The fundamental reason for viewing special contracts with disfavor, whether between public utilities and municipalities, or between public utilities and other patrons, is that service rendered must be paid for, and if the patron receiving the service is permitted under a contract to pay for such service less than his reasonable share, then an additional burden is laid upon other patrons to make up the difference, and as we view it, each patron, whether a municipality or a private corporation, an association or an individual, should pay the established rate for what service he demands."

NEWSPAPER VOICES POPULARITY OF ELECTRIC COMPANY.

Good service, courtesy and a sincere desire to ease the burden of modern conditions, on the part of a public utility, are never unappreciated by the community. The following is taken from the Mt. Clemens (Mich.) *Monitor:*

Certainly an electric company has an advantage over a telephone company or a railroad company because in its operation people are not eternally subject to the little annoyances that are cumulative, like some preferred stock. When you turn a button the line is not busy and you don't get something that you don't ask for. Neither do you hang onto a strap or stand on a corner and wait. You turn the button, and there's your service. Apart from this difference in operation the Detroit Edison Co. is a wise old bird. In spite of increased costs it holds rates down, and this it accomplishes by some of that efficiency which now and then is all right.

So it is that the Detroit Edison Co. is distinctly popular with everybody. When it tells customers that coal is short and they must reduce consumption of current, there is no complaint. The company's word is taken at par. It is just that strong in the confidence and affection of the public.

TELLS NEED OF CO-OPERATION WITH ARCHITECTS.

In a paper read before the Pacific Coast Section of the National Electric Light Association at its recent annual convention, Garnett Young, of San Francisco, urged the need of central-station companies co-operating with architects in the education of the public as to the use of the proper number of outlets in homes.

The paper was written in a manner to appeal to all hearers and to this end a number of paragraphs in it were devoted to establishing for the benefit of the architect and builder a complete alibi as to past sins of omission which have resulted in the present deplorable insufficiency of wiring in homes.

COMMONWEALTH EDISON CO. PLANS OUTING FOR EMPLOYES.

The Commonwealth Edison Co., Chicago, will give every possible employe a holiday on Saturday, July 10, the occasion being the annual outing and field day of the employes of the company. In the past the field day has been an afternoon and evening affair, but this year the entire day will be devoted to pleasure. The outing will be held at Riverview Park, Chicago, and will be under the auspices of the Edison Club. Entertainment of a professional character as well as "stunt" events for the employes will make up the program.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

NEW GENERATING PLANT PLANNED FOR CITY OF PARIS.

Steam Will Be Used at 350 Lbs. Pressure and 750 Deg. F., in Turbines of 35,000-Kw. Capacity to Serve the Entire City.

In an address before a recent meeting of the Washington Section of the American Institute of Electrical Engineers, Harold Goodwin, of the General Electric Co., Schenectady, N. Y., gave a description of a new power plant proposed to be built for the city of Paris, France. This plant is designed to consist of seven steam-turbine generators of 35,000-kw. capacity each, the plan being to have the new plant supersede all existing plants in the city.

The boiler plant is laid out with four boilers of special design serving each turbine. There will be two banks of tubes in each boiler, with a set of superheater coils installed between the upper and lower tube banks. This arrangement was considered essential to the satisfactory operation of the plant at 350 lbs. per sq. in. pressure and 320 deg. F. of superheat. With such steam conditions, it is believed impracticable to use pumps or other auxiliary equipment direct on boiler-pressure steam, and therefore all the auxiliaries and the station light and power are to be supplied through small auxiliary turbines, one of which will be installed for each pair of main units. Unusual precautions are to be taken to insure continuity of operation to the auxiliary equipment, especially that of the boiler room.

Coal can be received either by boat on the river or by railroad car. When delivered by boat it is unloaded by cranes and sent either into storage yards or directly to the track hoppers, from which it is conveyed to crushing stations. When delivered by railroad cars, it is dumped directly from the car into the track hoppers. From the crushing station the coal can be carried either to the bunkers, of which there are three, or to the storage yards. Storage space is also provided for uncrushed coal, so that the maximum of flexibility in handling is attained. Recovery from stock, of both crushed and lump coal, is accomplished either by grab buckets on locomotive cranes or by the traveling crane, which swings about from each bunker. The crushed coal is conveyed from the bunkers to the boiler room by lorries traveling on overhead tracks that connect up the various parts of the system. The lorries deliver the coal into the small hoppers that supply the stokers.

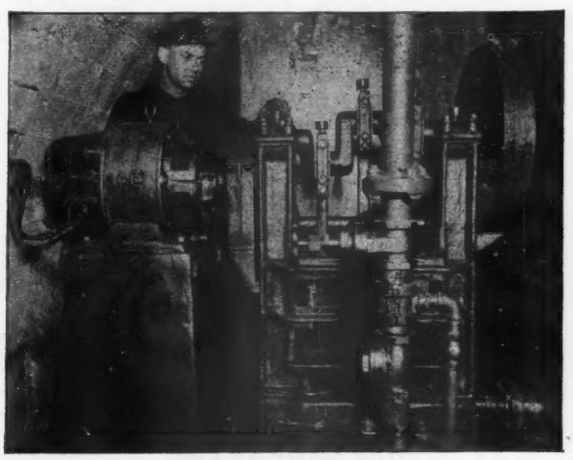
It has been estimated that the plant, as designed, would have cost approximately $45 per kw. of capacity on the basis of pre-war prices. The present cost has not been definitely calculated, but it is believed that it will be two or three times the pre-war figure, probably nearer three times.

As a result of the unfavorable conditions of international exchange, much of the boiler and plant equipment will be built abroad, although part of the electrical equipment will be constructed in this country. Since no final estimate of the power required for all of the auxiliaries has yet been completed, the over-all efficiency of the plant has not been estimated, but it is believed that not more than 10 lbs. of water will be required per kw-hr. With the normal power for auxiliaries this would require approximately 1.25 lbs. of coal per kw-hr.

UNDERGROUND PUMPING STATIONS IN NEW YORK CITY.

Electrically Driven Seepage and Emergency Pumps Controlled by Automatic Float Switches in New York Subways.

One of the problems of subway construction is to get rid of the water that invariably drains



Subway Sump Pump Driven by 2-Hp. Motor and Controlled by Automatic Float Switch.

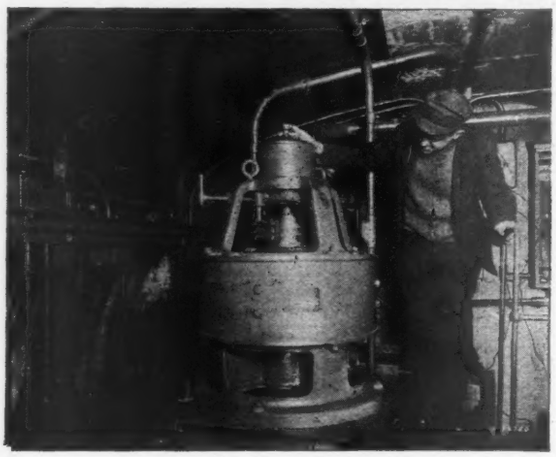
into all underground structures. In the deep tunnels of the New York municipal railway, operated by the Brooklyn Rapid Transit Co., which will run from Brooklyn through Manhattan and into Queenborough, this problem is particularly serious so that the methods used by this company are of interest.

The accompanying illustrations show a pumping installation that is typical of the 25 stations draining this system. It is located 70 ft. underground at Third and Lexington avenues, Manhattan, and is designed to take care of the tunnel under the East river.

There are two pumps, one a 4 by 6-in. Gould triplex plunger type, with capacity of 50 g. p. m., driven by a 2-hp. d-c. Westinghoue motor, and the other is a Morris centrifugal pump with a capacity of 1000 g. p. m., driven by a vertical

100-hp. d-c. Westinghouse motor. Under normal conditions the small pump has ample capacity to take care of the seepage, but emergencies are of course possible, especially with a tunnel running under a river, and then the large pump is needed.

Both pumps are arranged for automatic control. The water collects into a sump in which there are two float switches, one for each motor, and when the water level rises to a pre-determined point the float switch of the smaller motor



Vertical 100-Hp. D-C. Motor Driving Centrifugal Sump Pump In New York Subway.

closes. This energizes an automatic contactor which starts the pump. When the level of the water in the sump is brought down to the proper level, the float switch opens and stops the pump. But should the smaller pump be unable to handle the flow, and the water continues to rise, the large pump is automatically started.

A noteworthy feature of the installation is that it occupies a floor space of only 12 by 15 ft.

NEW PLANT TO BE FIRED WITH PULVERIZED COAL.

The Lakeside Plant in Milwaukee Will Be the Largest Power House in the World Fired With Pulverized Fuel.

The new Lakeside power plant of the Milwaukee (Wis.) Electric Railway & Light Co. will contain an installation of eight 1306-hp. Edgemoor water-tube boilers fired with pulverized coal, the furnaces being arranged to operate continuously at 250% of boiler rating. The first generating unit to be installed will have a capacity of 40,000 kw. and provision is being made for the addition of further units to give an ultimate station capacity of 200,000 kw.

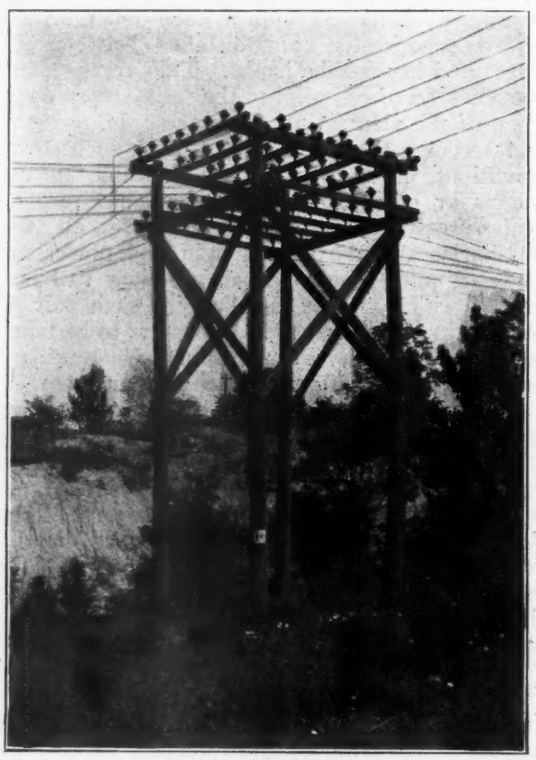
The contract for the coal drying, pulverizing and transportation equipment has been placed with the Fuller Engineering Co. of Allentown, Pa. The drying equipment will consist of Fuller indirect pulverized-coal fired rotary dryers with induced draft and complete dust-collecting equipment. There will be eight Fuller pulverizers and a complete Fuller-Kinyon pulverized-material pumping system for delivering the coal from the pulverizing plant to the bins above the boilers. This installation is now under construction and the first four boilers are expected to be put into operation by Dec. 1, 1920. This will be the largest power house of boilers fired with pulverized coal in existence, and, no doubt, will attract attention from all engineers interested in fuel economy.

The fact that this company has decided on the use of pulverized coal in the new plant speaks well for the future use of this fuel since, for over two years, it has been operating five boilers with pulverized coal in its Oneida street plant.

FOUR-POLE WOODEN TOWER USED TO TURN TRANSMISSION LINES.

Simple Construction Adopted for the Support of Splices at a Corner of a 27,000-Volt Double Transmission Line.

An interesting type of tower construction was employed in making a right-angle turn in a double transmission-line near the hydroelectric plant of the Indiana & Michigan Electric Co., at Berrien Springs, Mich. These lines, which have a working potential of 27,000 volts, span the St. Joseph river, being supported on one side by strain insulators attached to the power-house



Wooden Tower for the Support of a Double Transmission-Line Corner.

structure and on the other side by a rectangular steel tower. Just beyond this steel tower the lines are turned to run parallel to the course of the river.

A wooden tower constructed of four poles, set in the form of a square, was used to make the required corner construction. Another strain tower was set just beyond the corner tower so that the main-line strains were not carried by the wooden structure. The corner tower, which is shown in the accompanying il-

lustration, is in reality only a support for the splices between the lines running at right angles from this point. However, as may be noted from the illustration, each arm supporting a conductor is guyed back to a short stub pole set and anchored beyond the corner tower. The lines are so attached to the tower structure, through a number of pin-type insulators, that they are fixed in position and could not be disturbed by any ordinary accident.

LARGE STEAM TURBOGENERATOR HAS RECORD RUN.

Oiling System Is Important Factor in Exceptional Operating Performance of Large Turbogenerator Set Installed in Providence, R. I.

Operating without a shutdown for a period of 84 days, 11 hrs. and 36 min., the 45,000-kw. Westinghouse turbogenerator at the power plant of the Narragansett Electric Lighting Co., Providence, R. I., recently established a record for the continuous operation of a multiple-element steam turbine of the cross-compound type. During this run there were generated 51,104,000 kw-hr., or considerably more than that company's total output for any year prior to 1915. In fact, this unit generated about 85% of the total station output. Furthermore, this record was made with the load varying from a minimum of 6000 kw. to a maximum of 41,000 kw.

To some extent this continuous operation was made possible by means of an 800-gal. self-contained lubricating system. Oil is pumped through a cooler to the bearings at the rate of 600 gals. per hr.

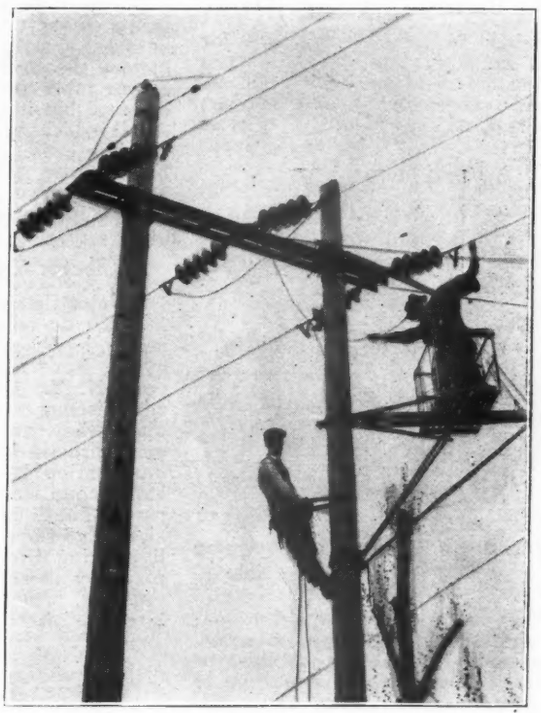
One of the most important features of this run was the fact that the turbine was operating under ordinary conditions. No preparation was made for the run, for when the unit was started early last December there was no thought other than to operate for a week, which is the ordinary period of a run. Abnormal weather conditions, however, brought about such a demand for power that it was not considered economically advisable to shut down the unit until the conditions were relieved. Even at the time the run was ended it was not necessary to stop the turbine, but existing station conditions allowed this procedure.

HIGH-VOLTAGE CIRCUITS WORKED WITH BARE HANDS.

Insulating Platform Is Used to Protect Workmen While They Make Repairs on Working Lines of High Voltage.

Various methods have been developed from time to time for the working or repairing of live high-potential circuits. Most of these methods involve the insulation of the workman from the wire and make little or no provision for his isolation from the ground or from grounded parts. However, at least one working scheme has been evolved and worked out in a practical manner for the repairing of high-voltage lines without recourse to rubber gloves, long-handled tools or similar devices.

The accompanying illustration shows three men working on a 33,000-volt line without the use of insulation between themselves and the conductor. There is no discomfort to the workman engaged in this style of live-wire work and there is only a slight "zip" similar to a static discharge when making and breaking contact with the conductors. Insulators can be tested and changed, slack can be cut in or out of the conductor, switches may be installed, crossarms may



Working on a 33,000-Volt Line from a Safety Staging of Special Design.

be installed, line taps may be made, and, in fact, almost any job on a high-tension circuit may be done from the insulated platform.

The insulated platform, when properly erected, offers a better footing for many jobs than any position that a man can take either on a pole or on a crossarm, regardless of whether the lines are dead or alive.

VARIABLE-SPEED MOTOR OF LARGE SIZE TO BE INSTALLED.

A 2000-hp. motor will be used as the main driving unit for a new rod mill being installed in the plant of the Interstate Iron & Steel Co., Chicago. Service will be supplied to this motor at 2300 volts, three phase and 60 cycles and its operating speed will be variable from 150 to 250 r.p.m. Another motor of 1500-hp. capacity will be used in connection with the operation of this mill and numerous motors of smaller size will be required.

Two 300-kw. motor-generators and three 125-hp., motor-driven pumps will be installed, together with the other equipment, the entire installation now under way amounting to approximately 6000 hp. of motor equipment.

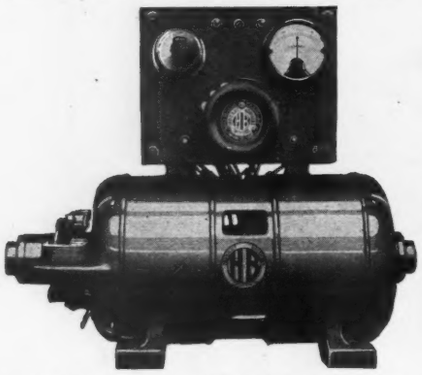
Service for this equipment will be supplied from the lines of the Commonwealth Edison Co. at a pressure of 12,000 volts, which will be reduced to 2300 volts for distribution and use.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Small Battery-Charging Outfit.

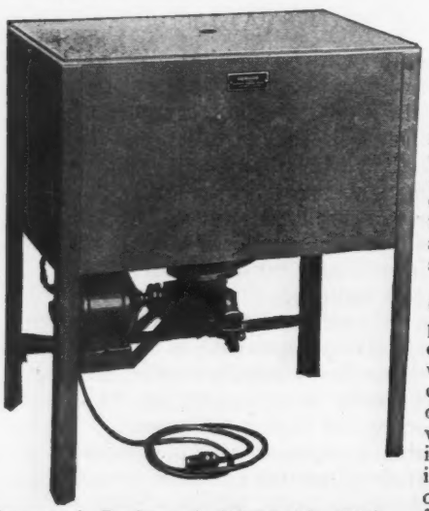
A battery-charging set suitable for use in small garages, where only a limited amount of service is required, has been developed by the Hobart Brothers Co., Troy, O. This set, as can be seen from the illustration, consists of a motor-generator with a control and regulating panel attached. The capacity of the outfit is 250 watts, making it suitable for charging up to four batteries at a time. The machine is provided with ball bearings making its operation quiet and efficient.



Motor-Generator and Panel for Charging Automobile Batteries.

Electric Dishwasher.

The increasing cost and scarcity of domestic service is producing an ever-increasing demand for appliances that reduce the amount of labor required in the hotel, restaurant and home. To meet this demand, the Wolcott Manufacturing Co., Hartford, Conn., has developed a new and improved model of the electrically operated "Mermaid" dishwasher.



Improved Design of "Mermaid" Dishwasher.

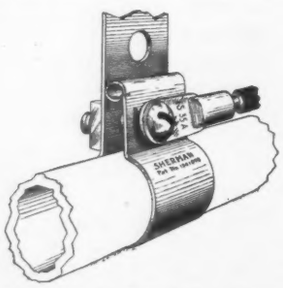
The new design embodies improvements in the gearing and motor suspension, a sliding castor to facilitate moving the machine, the adoption of a flat or table-top cover and a number of small but important refinements in detail which will be appreciated by the housewife. This model is being built at the new "Mermaid" factory at Middletown, Conn., which is just getting into production.

Reflector-Type Electric Sign.

An electric sign, built to show from 1 to 30 or more separate advertisements, has been placed on the market by the Root Electric Sign Co., Lockport, N. Y. In the daytime all the advertisements can be read, but at night they are illuminated, and so made prominent, one at a time. The illumination lasts for 5 sec., with a half-second intermission, for each display. The illumination for the entire sign is supplied by a single lamp, the light being directed to the various displays by means of a motor-actuated reflector. An automatic device regulates the starting and stopping of the sign.

All-Copper Ground Clamp for Power or Signal Service.

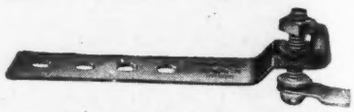
The grounding of circuits, conduits and structures in general has received a considerable amount of attention,



Ground Clamp Installed for Power and Lighting Service.

and all concerned are agreed that where grounds are essential they should be absolutely reliable. Every element involved in the installation of the ground connection should be suitable to its purpose and of such design as to assure its permanence.

The H. B. Sherman Manufacturing Co., Battle Creek, Mich., has just placed on the market a ground clamp designed to comply with the Underwriters' specifications. It is an all-copper, one-piece clamp which can be drawn up absolutely tight, and is provided with a suitably marked soldering lug. The roll portion is turned in to rest against the opposite tongue of the clamp, preventing the two ends from tipping together when tightened, holding the ears parallel and insuring the largest amount of drawing power. A countersunk space is provided at the proper angle to receive the head of the clamping bolt without the tearing through of the soft copper when pressure is applied. The countersunk space and washer form a holding device to receive and clamp the ground wire when a solderless connection is to be made. This particular feature is most important for work in connection with telephone, telegraph or other signal service.



Ground Clamp Suitable for Either Power or Signal Construction Work.

A screw-driver is the only tool required to install the clamp, and three sizes cover the requirements of connection to any size pipe up to 3 in. in diameter.

Drum-Contactor Controllers for Direct-Current Motors.

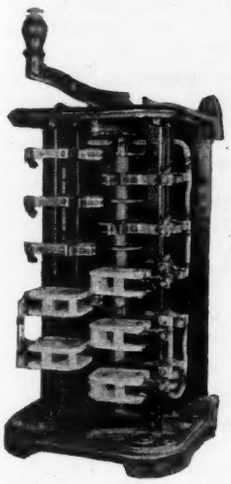
During the past year exhaustive tests have been made on a new type of d-c. motor controller which is being prepared for the market by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. This controller, which is known as the type S drum contactor, will be ready for distribution about Aug. 1. The service tests have indicated that the construction is superior in many ways to the drum and face-plate cotrollers formerly used. They combine many of the advantages of magnetic contactor controllers with small size, simple construction and low cost.

These controllers are used for starting and adjusting the speed of shunt, series and compound-wound d-c. mo-

Type-S Drum Contactor Controller for D-C. Motors.

tors by adjusting the resistance in series and parallel with the motor armature. They are applicable to cranes, hoists, crushers, bridges, roll and transfer tables, punches and practically all applications employing this system of control.

In operation, these controllers employ the same principles as magnetic contactor controllers except that the contactors are operated by cams mounted on the controller shaft. Normal movement of the controller handle causes the contactors to open or close with a quick, positive action



Motor Controller With Case Removed Showing Mechanism.

which reduces arcing. The arcing is further controlled by the rolling motion of the contacts, which limits all arcing and burning to the contact tips. Consequently there is no pitting, roughing or burning of that part of the contacts where the load current is carried. Final contact is made with a slight wiping motion which insures clean contact surfaces and maximum current-carrying capacity. The line contactors, which open and close the main-line circuit, are protected by magnetic blow-outs which aid in extinguishing any arcing that may occur.

Each contactor is closed by a hard-fiber cam, operating on a roller on the moving contact element, and opened by a compression spring when the cam is moved away from the roller. This prevents the shaft from becoming locked to a single contactor in such a manner as to prevent opening of the circuit. Each contact element is complete in itself and can be removed as a unit. The stationary and moving contacts are identical and interchangeable with those of the manufacturer's auto-starters and magnetic-contactor controllers.

All controllers are drilled and tapped for both horizontal and vertical handles, and the horizontal handles of controllers in service can be readily replaced with vertical handles or vice versa. The vertical type is fastened to the top of the controller by four bolts spaced equally distant from the controller shaft and from each other. This permits it to be mounted in any one of four positions, 90 deg. apart, to facilitate the placing of the controller in the most convenient manner, and still to provide easy operation from any position. The controllers will operate satisfactorily when mounted in any position, as the contactors are spring-actuated and their operation is not affected by gravity.

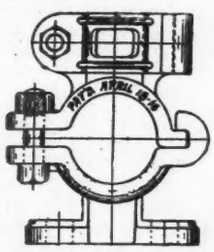
Each controller embodies all such desirable features as conduit wiring, inclosed current-carrying parts, protection against the controller being locked in running position and prevention of accidental starting or reversing. This type of controller is supplied both with and without dynamic braking. Controllers for use with crane hoists regulate the speed of the motor while lowering by dynamic or regenerative braking. They are so designed that if there is not sufficient weight on the hook or cage to revolve the motor and drums the motor will assist in the lowering. The speed of the motor is always under the accurate control of the operator, both when hoisting and lowering, regardless of the load. Cranes equipped with these controllers can have very high lowering speeds if the motor used is capable of standing such operation.

Threadless Pipe-Fittings for Panel Boards.

In the construction of switch and panel-board supports, considerable time is necessary to assemble and apply the ordinary U-bolt fittings used for this purpose.

The McIntire Corp., 35 Vesey street, Newark, N. J., announces the production of a line of threadless pipe-fittings to simplify the work of assembling boards on pipe supports.

The use of threadless fittings not only affords a saving in labor, but also provides an adjustability not obtainable in other fittings, and, due to the leverage of the fittings, only a slight tension on the bolts is necessary to produce a satisfactory grip.



Threadless Fitting for Two Panels.

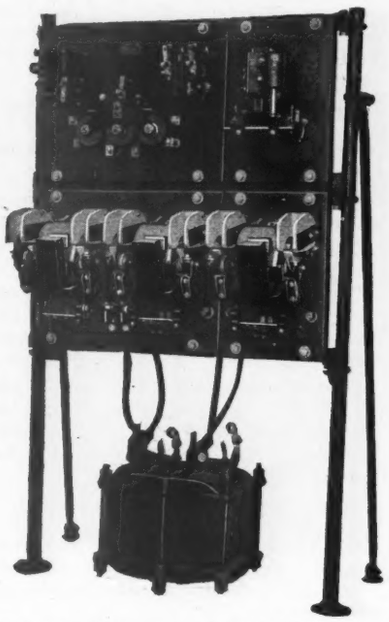
The threadless type of fitting has an advantage over other types, in that it is more easily and quickly applied, requires but one bolt per pipe, is interchangeable, compact, strong and inexpensive.

Fittings are supplied in a variety of shapes and may be secured for attachment by expansion shells as well as by pipe clamps.

An Automatic Motor-Starter for Slow Acceleration.

Squirrel-cage induction motors, when driving loads of great inertia, sometimes require several minutes to come up to speed. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has developed an automotic controlling equipment to meet such service conditions. This controller is essentially an automatic starter of the auto-transformer type, and consists of three double-pole magnetic contactors, two auto-transformers, a current-limit relay and a time-limit relay, with the necessary auxiliary magnetic switches. The switch equipment is mounted on slate panels carried on a floor-type frame, with the transformers mounted separately.

One contactor acts as a main-line switch, and the other two connect the motor to the starting taps of the transformers and to the line respectively.



Motor-Starter for Squirrel-Cage Motor Carrying Loads of High Inertia.

The interval between the closing of the second and third contactors, which is the time given the motor to come up to speed, is governed by the series-current relay and the dash-pot relay, either of which is externally adjustable for current or time values.

The use of both relays is made necessary by the variety of requirements involved in the starting of this type of load. Time relays are generally unreliable when set to operate at a longer time interval than 10 or 15 sec., and so cannot be used by themselves under the above conditions of starting. Series-current relays are reliable over a wide range of current values, but, if set to release at the low current values obtained when starting under normal conditions, they will usually fail to function should the load be increased even slightly or the line voltage fall below normal. On the other hand, if set for higher values, the series relay will connect the motor to the line before it has reached speed under normal conditions of load and line voltage, thus drawing undesirable peak currents from the line. By combining both types of relays, the current relay is made to function first, it being set for such a current value that its operation will be assured under practically all conditions of load and line voltage. The dash-pot relay operates to give the proper time interval after the current relay has functioned.

Control of this automatic starter may be by push-button stations, snap switches or other contact-making device operated from any remote point. The adjustable feature of both relays makes this starter applicable to almost all operating conditions.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Globe Electric Co., Milwaukee, Wis., is receiving bids for a machine shop unit to increase the capacity of its present plant.

Pioneer Electric Service Corp., Brooklyn, N. Y., has filed notice of an increase in its capital stock from $20,000 to $120,000.

Eager Electric Co., Newall street, Watertown, N. Y., manufacturer of dynamos and motors, is planning for the erection of a one-story foundry.

White Donnelly Electric Co., New York City, has leased property in the building at Lexington avenue and 86th street, for a new establishment.

Phillips Insulated Wire Co., Pawtucket, R. I., has completed plans for the construction of a one-story manufacturing building to be located on Winthrop avenue.

New Jersey Electric Supply, 207 Washington street, Newark, N. J., has filed notice of organization to manufacture electric equipment. Peter Tenk, 427 Belmont avenue, heads the company.

Electric Hammer Corp. is now the name of the Reciprocating Electric Tool Co., Louisville, Ky. The corporation is headed by James K. Jarvis as president, and has capital stock of $1,000,000.

The Habirshaw Electric Cable Co., 10 East 43rd street, New York City, manufacturer of electrical wires, cables, etc., has completed plans for the erection of an addition, 60 by 100 ft., to its plant at Glenwood dock, Yonkers, N. Y., to cost about $30,000.

Whitelite Electric Co., New York City, manufacturer of nitrogen lamps, manufactured under General Electric Co. patents, has issued a new price list on clear, frosted, daylite and daylite frosted lamps from 40 to 500 watts rating.

Lesser Brothers & Kurz, 58 Spring street, New York City, have begun the manufacture of pearl disks for use in flush switches. These disks are made of ocean pearl and in sizes to meet the requirements of all electrical switch manufacturers.

Lapp Insulator Co., Inc., LeRoy, N. Y., has issued catalog No. 2 describing and illustrating the uses of the various types of insulators manufactured by the company, together with tables of data of interest to all persons having wiring problems.

Sprague Electric Works of General Electric Co., 527 West 34th street, New York City, has issued bulletin No. 44553.1, under date of June, 1920, describing the Sprague line of flexible steel armored hose for railroad service. Bulletin No. B-3567 dealing with flexible steel armored hose for industrial work has also been recently issued by the company.

Wythe Electric Light, Power & Warehouse Co., Brooklyn, N. Y. has filed notice of dissolution.

Pittsburgh Gage & Supply Co., 30th street and Liberty avenue, Pittsburgh, Pa., manufacturer of electrically operated washing machinery, etc., has inaugurated work on the construction of a one-story building, about 64 by 106 ft., at 3026 Liberty avenue, to cost $50,000.

Driver-Harris Co., Middlesex street, Harrison, N. J., manufacturer of electrical resistance wires, metal alloys, etc., has arranged for a preferred stock issue of $750,000, making a total capitalization of $3,000,000, for proposed additions and improvements in its plant. The present works comprises a total of 16 buildings, giving employment to about 800 persons. The company also operates plants at Walkerville, Ont., and Manchester, England.

F. W. Wakefield Brass Co., Vermilion, O., has issued two new leaflets describing Wakefield "Red Spot" suspensions for the Ivanhoe "Trojan" and Phoenix "11-8-12" high-powered lighting units. The Wakefield "Red Spot" suspensions, it is pointed out in the leaflets, are in accord with the present-day tendency toward the standardization and simplification of the fixture business. The product is cartoned, one to a box, and plainly labeled so that the suspensions arrive at the job in exactly the same condition they leave the factory.

Wellman-Seaver-Morgan Co., Cleveland, O., has issued a series of bulletins on recent installations by the company, the bulletins covering the following subjects: No. 41, coal and ore handling machinery; No. 42, special cranes; No. 43, hydraulic turbines; No. 44, hoisting and mining machinery; No. 45, steel works equipment; No. 46, coke oven machinery; No. 47, port and terminal equipment; No. 48, rubber machinery. The scheme of each of the bulletins is to show on facing pages a picture of the particular installation and a working blue print of each machine.

Maynard Electric Steel Casting Co., Milwaukee, Wis., has increased its capital stock from $125,000 to $250,000 to finance increased production and additions to its works on Kilbourn road, near Oklahoma avenue. The present plant was erected 18 months ago and is 150 by 240 ft. in size. A one-story addition, 30 by 200 ft. is now being made to the molding floor, and the cleaning and shipping room will be enlarged 50 by 75 ft. The company specializes in general machinery castings and manufactures electric steel exclusively. The officers are: President and treasurer, Liebrecht Berger; secretary, Julius K. Fons; general manager, Frank J. Wabiszewski.

Phelps Light & Power Co., Rock Island, Ill., has issued two large folders describing in detail the merits claimed by the company for its 1500-watt motor for furnishing light and power for farm use.

Oakley Chemical Co., 22 Thames street, New York City, has placed on the market under the name of "Oakite," a cleaning compound said to be particularly effective in electric washing and dishwashing machines. "Oakite" is not a soap, but is a distinctive preparation which emulsifies grease and oil into minute particles which are washed away by the action of the water.

Blaw-Knox Co., Pittsburgh, Pa., has issued in book form a series of articles on steel transmission towers, prepared by E. L. Gemmill, chief engineer of its transmission tower department, and read before the company's engineering society. These articles appeared in ELECTRICAL REVIEW in the issues of March 6, April 3, April 17, May 1 and June 5. The articles constitute a detailed summary of modern engineering practice in the design and installation of towers and of the theory and practice regarding suspension spans, sag calculations, and spacing of conductors. In addition to the articles, the book contains tables giving the properties of wires, sags, loads and curves, formulas, etc., to make it a comprehensive reference book for those interested in the subject of transmission towers.

Bridgeport Brass Co., Bridgeport, Conn., has issued recently a pamphlet entitled "Brass." An unusual feature about it is that, although it is issued primarily for advertising purposes, it has an educational value not often found in promotional literature. The pamphlet contains a historic sketch of the metallurgy of brass and its elements from prehistoric times to the present day. Little is known now about the methods employed by the ancients in producing the elements or their alloys. It is known, however, from references in the literature that has survived and from relics that have been unearthed on the sites of ancient cities that bronze articles were used in Egypt as far back as 4700 B. C. The pamphlet traces the gradual development of foundering from the earliest periods, when it was an art until the present when it is a pure science, regulated by the laws of chemistry and physics. As may be expected, electricity is responsible for much of the development, so much in fact that the company does all of its melting in electric furnaces. The pamphlet, which is profusely illustrated, describes the methods employed in manufacturing brass and in testing and annealing it, discusses its metallurgy and properties, and contains stress, equilibrium and other property diagrams.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

J. M. BROWN has resigned as engineer of the Dominion Power Transmission Co., Hamilton, Ont., to take a position on the Provincial Board of Examiners.

DR. F. O. COTTRELL, chief metallurgist of the United States Bureau of Mines, has been appointed chief of the bureau, succeeding V. H. Manning, who recently resigned.

HARRY I. BEARDSLEY has resigned as supervising mechanical designer with the Crocker-Wheeler Co., Ampere, N. J., and is now associated with the Western Electric Co., New York City, in the capacity of specification engineer.

A. DWIGHT SMITH, former sales manager of the Northern Electric Co. in the Montreal, Que., district, has been transferred to the home office of the company at Montreal, and placed in charge of train dispatching, fire alarm and marine supply sales.

WILLARD S. SISSON, secretary and treasurer of the D. & W. Fuse Co., severed his connection with the D. & W. works June 15, as the plant is now operated by the General Electric Co. under a long term lease. Mr. Sisson will continue in the electrical business and will announce his plans in the near future.

L. P. ANDREWS, elected president of the Missouri Association of Public Utilities at the recent convention held in Jefferson City, Mo., is secretary, treasurer and manager of the City Water Co., of Sedalia (Mo.), and is also a member of the American Water Works Association. Although not connected with the electrical industry, Mr. Andrews has taken a deep interest in all utility company problems in his state and is well informed as to the needs of the electrical industries in Missouri.

L. P. Andrews.

ROY F. MAPES has resigned as telephone engineer of the Michigan Public Utilities Commission to accept a position as general manager of the Valley Home Telephone Co., Saginaw, Mich.

WILFRED SYKES, formerly general engineer on steel mill and marine work for the Westinghouse Electric & Manufacturing Co., has resigned to enter the employ of the Steel & Tube Co., Chicago.

WALTER MCKEAN, formerly with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed purchasing agent and traffic manager of the Edgewater Steel Co., Pittsburgh, Pa.

W. S. FINLAY, JR., superintendent of motive power of the Interborough Rapid Transit Co., New York City, has resigned to accept the position of vice-president of the American Water Works & Electric Co., New York City.

MAJ. ROUNDELL PALMER, who has been acting as manager of the public utilities of Brockville, Ont., has resigned to take charge of installation work for the Canadian Hydro-Electric Commission at Alexandria, Ont.

N. S. RICHARDS, for the past three years sales manager of the Calgary (Alta.) branch of the Northern Electric Co., has been transferred to Montreal, Que., as sales manager for the company in the Montreal district.

C. O. VAN DER VORT, before the war, telegraph and telephone engineer of the Michigan Central railroad, and during the war in military service in France, is now connected with the Western Electric Co. at East Orange, N. J.

THOMAS E. MURRAY, vice-president of the New York Edison Co., New York City, had the degree of doctor of science conferred on him by Villa Nova College, Villa Nova, Pa., at the commencement exercises of the college last week. Mr. Murray is one of the best known and most able men in the electrical industry today. In addition to his association with the Edison company he is president of the Yonkers (N. Y.) Electric Light and Power Co., and vice-president of the United Electric Light and Power Co. He is a director of the Brooklyn Edison Co., the Electrical Testing Laboratories and the Manhattan Refrigerating Co.; is the founder of the Metropolitan Engineering Co. and of Thomas E. Murray, Inc., and has served in various capacities in practically all of the electrical associations and engineering societies. For his research and productive work during the world war he received a citation from the War Department. He received the degree of doctor of laws from Georgetown University in 1919. Mr. Murray's most noteworthy engineering achievements include the planning of the waterside stations of the New York Edison Co.,

Thomas E. Murray.

the Sherman Creek and Hell Gate stations of the United Electric Light and Power Co., the plants of the Brooklyn Edison Co., and the hydroelectric development of the Chattanooga and Tennessee River Power Co. He bears the unique distinction of having installed more power plant capacity than any other man. In 1910 the Franklin Institute awarded Mr. Murray the Edward Longstreth Medal for his system of safety devices and protective appliances for interior electric wiring. Altogether Mr. Murray has been granted more than 350 patents, principally for electrical inventions.

OBITUARY.

HARRY T. WILLETT, former secretary of the Springfield Light, Heat & Power Co., Springfield, Ill., died at Decatur, Ill., June 9.

CHARLES ETHAN BILLINGS, an inventor of prominence and a pioneer in the manufacture of drop forgings and forging machinery, died at his home, Hartford, Conn., June 5, aged 83 years. He was the head of the Billings & Spencer Co., Hartford, Conn., which he established in 1869.

JOHN C. MOORE, vice-president and director of sales of the North & Judd Manufacturing Co., New Britain, Conn., died May 26 at his home in New York City of a complication of diseases after a long illness. Mr. Moore was 52 years of age.

WILLIAM J. KREIDLER, chief electrician at the Illinois state capital, Springfield, Ill., died recently, aged 41 years. Mr. Kreidler was formerly employed by the Mississippi River Power Co., with headquarters at Hannibal, Mo. He had been electrician at the state capitol since November, 1917.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Springfield, Mass. — The United Electric Co. has completed plans for the erection of an addition to its plant on Carew street, to cost about $100,000.

Worcester, Mass.—The Norton Co., New Bond street, manufacturer of abrasive products, has construction under way on a six-story addition to its plant, 75 by 150 ft., to cost about $300,000, including equipment.

Wallingford, Conn.—The International Silver Co., State street, Meriden, Conn., will make extensions and improvements in the power house at its Wallingford works, to cost about $25,000.

Brooklyn, N. Y.—Stephen Ransom, 401 West street, New York City, operating a marine repair works, will build a new transformer station and power house in connection with his branch works at 518 Hamilton street, Brooklyn. The entire plant will cost about $250,000.

Brooklyn, N. Y. — The Brooklyn Rapid Transit Co., 85 Clinton street, is planning for the installation of a 5- and a 15-ton capacity electric traveling crane at its shops.

Buffalo, N. Y.—The Buffalo General Electric Co., Genesee and Washington streets, has had plans prepared for the erection of an addition to its power station at Babcock and Hannah streets, to cost about $20,000.

Dunkirk, N. Y.—The Niagara & Erie Power Co., Marine Bank building, Buffalo, has made application to the State Public Service Commission for permission to build an addition to its power plant at Dunkirk, and for extensions in its electric power system in this district.

Jamaica, L. I., N. Y.—The Dictograph Products Co. has filed plans for the erection of a one-story boiler plant at its works on Schooley place, 26 by 50 ft., to cost about $18,000.

New York, N. Y. — The Seneca Copper Co., 11 Broadway, has filed notice of increase in its capital stock to $1,250,000.

New York, N. Y. — Considerable electrical and mechanical equipment will be installed at the proposed new municipal disposal plant to be erected by the Commissioners of Plant and Structures. The plant is estimated to cost about $750,000.

New York, N. Y.—The Bronx Gas & Electric Co. has filed plans for the erection of an addition to the oil department at its plant on Watson avenue.

New York, N. Y.—The New York Telephone Co. has acquired property, 50 by 100 ft., at Convent avenue and 146th street, to be used for extensions in its exchange plant at this location. Plans are under way for the construction of a three-story central exchange plant at Gates and Fairview avenues, Queens, and for extensions to the three-story exchange plant at 16th street and 71st street, Brooklyn.

Tonawanda, N. Y. — The Tonawanda Power Co. has made application to the State Public Service Commission for permission to build an addition to its electric power plant at Grand Island.

Yonkers, N. Y.—The Yonkers Electric Light & Power Co. has awarded a contract to the J. Canepe Contracting Co., for the erection of a two-story, steel and reinforced concrete transformer plant, 100 by 225 ft., to cost about $200,000.

Essex Fells, N. J. — The borough council is considering a proposition for the purchase of the former electric light and pumping station of the Essex Fells Electric Light & Water Co., located near the Erie railroad, to be used for municipal service. The plant has been offered for $175,000. Service is now being furnished by the Public Service Electric Co.

Lakehurst, N. J. — The United States Bureau of Yards & Docks, Washington, D. C., has completed plans and will soon receive bids for the construction of an electric power plant and distributing system here, to cost about $400,000. The work will include three turboalternators, two exciter sets, switchboard and auxiliary apparatus, motors, etc.

Newark, N. Y.—The following bids were received by the board of education for electrical work in connection with the Seymour Vocational School: engines and generators, Jandous Electrical Equipment Co., $32,475; electrical work, Beaver Engineering Co., $27,874; and heating and ventilating, Jaehnig & People's, Inc., $167,655. Bidders noted are all located at Newark.

Newark, N. J.—The Schofield Oil Co., Avenue R, has filed plans for the erection of a one-story engine and power house at its plant to cost about $30,000.

Newark, N. J.—M. Straus & Sons, 508 Frelinghuysen avenue, have had plans prepared for the erection of a boiler plant at their leather factory, 40 by 80 ft., to cost about $30,000 Two units will be installed and considered auxiliary apparatus.

Newark, N. J.—The Foster Engineering Co., 107 Monroe street, manufacturer of automatic valve specialties, etc., has had plans prepared for the erection of a four-story addition, 63 by 100 feet., to cost about $120,000, including equipment.

Perth Amboy, N. J.—In connection with the additions to its plant, the Perth Amboy Dry Dock Co., foot of Broad street, will install considerable electric machinery and equipment. A large drydock is now being constructed, and is expected to be ready for service in the next few months; pumps, valves and other equipment used in operation will be of electrically driven type. A new boiler shop, angle and plate shop, and other mechanical buildings will be provided with electrically operated tools and equipment. A floodlighting system will be installed to extend to all parts of the plant, similar to the system used at the Hog Island yard, Philadelphia, Pa. The lighting units will be mounted on high poles.

Pompton Plains, N. J.—The Pequannock township committee has passed an ordinance granting permission to to Boonton Electric Co. to install and operate a system in the Jacksonville and Lincoln Park sections. A new pole line and distributing system will be constructed. The Tri-County Electric Co., Pompton Lakes, is operating in the Riverdale and Pompton Plains sections of the township.

Rahway, N. J.—The State Board of Public Utility Commissioners has ordered the Middlesex Water Co., to install new booster and pumping equipment at its local plant. The new apparatus is to have a capacity of 4,000,000 gals. of water a day.

Trenton, N. J. — The Underfeed Stoker Co. of America, Chicago, a New Jersey corporation, has filed notice of increase in its capital stock from $1,000,000 to $1,250,000.

Philadelphia, Pa.—The department of public works has arranged for the installation of a new ash handling system at the Torresdale pumping station to cost about $50,000.

Philadelphia, Pa.—Plans have been filed by the A. & F. Dry Cleaning Co. for the erection of a one-story boiler plant at its works, 6109 Larchwood avenue.

Philadelphia, Pa.—Powers, Weightman & Rosengarten, Ridge avenue, manufacturers of chemicals, have had plans prepared for the erection of a one-story addition to their boiler plant.

Philadelphia, Pa.—The Enterprise Manufacturing Co., Third and Dauphin streets, will build a power plant at its hardware manufacturing works, Bodine and Susquehanna streets, to cost about $28,000.

Philadelphia, Pa.—The McCaffrey File Co., Fifth street, has filed plans for extensions and improvements in its boiler plant.

Philadelphia, Pa.—Plans have been prepared by the Hale & Kilbourne Corp., Eighteenth and Lehigh streets, manufacturer of iron and steel products, for the erection of an addition to its power plant, with installation

to include boilers, stokers and auxiliary equipment. The work is estimated to cost $60,000.

Pittsburgh, Pa. — The West Penn Power Co. has acquired property at Springdale, aggregating about 80 acres of land, from the Allegheny Iron & Coal Co. for a consideration of about $103,000. The site will be used by the company in connection with expansion in operations at this location.

Pittsburgh, Pa. — The Pittsburgh Model Engine Co. has filed plans for the erection of a one-story addition to its plant at Lexington avenue and McPherson boulevard.

Shippensburg, Pa. — The American Telephone & Telepgrah Co., 195 Broadway, New York City, is planning for the erection of a two-story testing plant here, 50 by 82 ft.

York, Pa.—The boiler and engine plant, with machinery, at the works of the Union Stone Co., Saginaw, near York, was destroyed by fire, June 2, with loss estimated at $30,000, including other machinery at the works.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. is reported to be planning for the erection of an addition to its substation in the vicinity of Graves and Constitution streets. The company has recently acquired additional property in this section.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. is taking bids for the erection of a substation at Port Covington.

Port Deposit, Md.—The Northern Maryland Electric Co., recently incorporated with a capital stock of $25,000, is planning for the operation of a plant in this section, for electric light and power service. John H. Ware, Jr., and J. Guy Eshleman head the company.

Laurel, Md. — The Maryland Motors Co., Munsey building, Baltimore, is having preliminary plans prepared for the erection of a hydroelectric power plant in the vicinity of Laurel, Md. T. B. Western is in charge of the project.

Pencader, Del.—The boiler plant at the fireworks factory of the A. Jedel Co. was destroyed recently by fire, in connection with damage to a portion of the main works. The entire loss is estimated at $30,000.

Bedford, Va.—The city council is having plans prepared for the erection of a hydroelectric plant, comprising an addition to its present station, to include the installation of new generating units. W. C. Whitney & Co., Virginia Railway & Power Co. building, Richmond, Va., is the engineer on the project.

Wheeling, W. Va. — The United States Bureau of Yards & Docks, Washington, D. C., is arranging for the immediate erection of a plant at Ohio River Lock No. 48, in the vicinity of Wheeling. Bids for the project recently received have been rejected.

Fayetteville, N. C.—The Cumberland Railway & Power Co. has increased its capital stock to $1,000,000 for expansion purposes.

Spartanburg, S. C. — The South Carolina Light, Power & Railway Co. is planning for the construction of a transmission line to Whitney.

Safety Harbor, Fla. — The Oldsmar Light & Ice Co. will furnish electric energy for light and power purposes to the citizens and industries of Safety Harbor.

NORTH CENTRAL STATES.

Cincinnati, O. — The Cincinnati Tool Co., which recently increased its capital stock from $20,000 to $100,000, is erecting an extension to its plant.

Cincinnati, O.—The King Machine Tool Co. plans a two-story addition to its plant to cost $50,000.

Cleveland, O. — The Oster Manufacturing Co. has plans ready for a five-story factory building, 75 by 138 ft.

Cleveland, O. — The Baines Engineering Co. has acquired the plant of the Hinkle Manufacturing Co., Dover, O., for the manufacture of power cultivators.

Lima, O.—A contract for the installation of a boulevard system of electric lighting on Main street from the Pennsylvania railroad tracks to the north side of the public square, and on High street from West to Union streets, has been awarded to the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Niles, O.—The Electric Alloy Co. has purchased a 150-acre site and will erect a steel plant. Power for the operation of the plant will be obtained from the Pennsylvania-Ohio Electric Co.

Gary, Ind.—The O. K. Giant Battery Co., 515 Broadway, is receiving bids through Z. Erol Smith, 305 East 55th street, Chicago, on an 11-unit plant to cost $660,000.

Fort Wayne, Ind. — The Tokheim Pump Co. plans a new plant to cost about $15,000.

Hammond, Ind.—The Eclipse Automatic Manufacturing Co. will build a one-story machine shop, 42 by 72 ft., at an estimated cost of $12,000.

Hammond, Ind. — The Overland Crane Co. has bought the plant formerly used by the G. H. Hammond Packing Co. and will remodel it for the manufacture of locomotive cranes. P. J. McCain is the president of the company.

Kokomo, Ind.—The Kokomo Brass Works will build a one-story addition, 132 by 137 ft., to cost $100,000.

Portland, Ind.—The city has voted $120,000 in bonds for the construction of a municipal electric light and power plant. Address Portland Commercial Association, or Mayor C. O. Mitchell for further information.

Benton Harbor, Mich.—The Surenac Machine Co. has plans ready for a two-story addition to its plant, 80 by 100 ft. The estimated cost of the work is $50,000.

Detroit, Mich.—The Superior Machine & Engineering Co., 51 East Fort street, will build a two-story plant, 100 by 120 ft.

St. Johns, Mich.—Plans are being prepared for a municipal power and lighting plant, to cost from $240,000 to $280,000.

Chicago, Ill.—The Designer Instrument Co. plans a three-story factory building, 40 by 60 ft., to cost $30,000.

Chicago, Ill.—A contract has been let to the Thomas G. Gage Co., 29 South LaSalle street by the Commonwealth Edison Co. for the erection of a substation at an estimated cost of $25,000.

Chicago, Ill.—The By-Products Co. will erect a plant at Crawford avenue and 31st street at an estimated cost of $85,000.

Elgin, Ill. — The Elgin National Watch Co. has received bids and will soon award contracts on a group of four- and six-story laboratory and factory building to cost $1,000,000.

Rockford, Ill.—The Thayer Piano Action Co. will build a two-story machine shop to cost $15,000.

Taylorville, Ill. — The city is having plans prepared for a municipal electric light plant. Address Mayor Dowery for any further information.

Beaver Dam, Wis. — The F. Rassman Manufacturing Co., manufacturer of agricultural tools, is increasing its foundry capacity.

Byrds Creek, Wis. — The Byrds Creek Electric Light & Power Co. will build a transmission line from Blue River to Eagle Corners, passing through Byrds Creek.

Hilbert, Wis. — The city electric light plant was recently destroyed by fire.

Milwaukee, Wis.—The George P. Dravo Co., 1195 30th street, manufacturer of super-heaters, has broken ground for a one-story, brick and concrete factory and shop addition, 60 by 100 ft., to cost about $30,000, including equipment.

Milwaukee, Wis. — The Richards Machine Co. will build a one-story addition, 32 by 46 ft.

Milwaukee, Wis.—The John Obenberger Forge Co. has increased its capital stock from $250,000 to $500,000 and will enlarge its plant.

Oshkosh, Wis.—The Universal Motor Co. will build a three-story office and machine shop, 75 by 120 ft. E. H. Fahrney is the president of the company.

Wabasha, Minn.—The Wisconsin-Minnesota Light & Power Co., a subsidiary of the American Public Utilities Co., has purchased the Wabasha electric light plant.

St. Louis, Mo.—The Eureka Brass Co. will build a plant addition 50 by 148 ft.

St. Louis, Mo. — The Standard Stamping Co. is receiving bids for a five-story plant, 53 by 60 feet, to cost $75,000.

Meade, Kan.—The Artesian Ice & Light Co. has sold its plant to the city, bonds for the purchase having been voted at a recent election with only 10 dissenting votes.

Mt. Hope, Kans.—The city plans the erection of a $15,000 electric light plant. W. B. Rollins, 209 Railway

Exchange building, Kansas City, Mo., is the engineer in charge of the work.

SOUTH CENTRAL STATES.

Louisville, Ky.—The Illinois Malleable Iron Co. has prepared plans for an annealing shop, 113 by 183 ft., and a foundry, 147 by 263 ft., as the first units of the plant. The company has a 42-acre tract with railroad connections.

Memphis, Tenn. — The Memphis Gas & Electric Co. will erect a three-story booster station at a cost of $25,000.

Gadsen, Ala.—The Etowah Foundry & Machine Co., manufacturer of iron, brass and copper castings, will build a one-story machine shop. W. T. Murphee is the president of the company.

Monroe, La. — The Cumberland Telephone & Telegraph Co. will rebuild its telephone system at an estimated cost of $75,000.

Conway, Ark.—The city will improve its electric light and water systems, including the installation of new engine and generator. The improvements will cost about $12,000.

Bronco, Tex.—The Lovington Public Utilities Co., Lovington, N. M., will construct an electric light and power plant at Bronco. The company is capitalized at $50,000.

Gainesville, Tex.—Gainesville Telephone Co., is planning for extensions and improvements in its system to cost about $70,000.

Houston, Tex.—The Peden Iron & Steel Co. has increased its capital stock from $1,000,000 to $2,500,000.

Vernon, Tex. — The Texas Public Service Co., of which A. V. Foster, Toledo, O., is president, has under consideration extensions and improvements to its electric light and power plant which will involve an expenditure of about $100,00.

Wharton, Tex.—The electric light and power plant of the Texas Gas & Electric Co., recently destroyed by fire with a loss of $100,000, will be rebuilt.

Pawnee, Okla.—The common council has arranged for a bond issue of $100,000 for the establishment of a municipal electric light and power plant.

WESTERN STATES.

Oakland, Cal.—The Bay Engineering Co. has awarded a contract for the erection of a two-story shop building, to be built at an estimated cost of $13,000.

San Francisco, Cal. — The Bryon Jackson Iron Works is building a branch factory, 50 by 100 ft. Equipment will cost about $25,000.

CANADA.

Brandon, Man. — The Board of Trade will ask the provincial government to take up the proposition of developing power for Brandon at Currie's Landing, 8 mi. east of the city.

Brockville, Ont.—The Ontario Hydro-Electric Power Commission will extend its power line along the river road east of Brockville.

Edmonton, Alta. — The Hayward Lumber Co., will install two 60-hp. motors in their new factory in East Edmonton.

Kitchener, Ont. — The Kitchener light commission is calling for tenders for the erection of a new hydro-electric distributing station of 4500-kw. capacity.

Montreal, Que.—The plant of the St. Lawrence Welding Co., 138 Inspector street, was recently damaged by fire to the extent of $35,000.

Thornbury, Ont.—The Thornbury Electric Lighting Co. is planning the erection of a plant to cost about $15,000.

Toronto, Ont.—The Canadian Radio Corp., Ltd., is said to be planning for a local plant. The company was recently incorporated with capital stock of $5,000,000. Sir William McKenzie and Abram C. Wisner head the company, which will manufacture electrical machinery and tools.

Winnipeg, Man.—J. McDonald and Co. were awarded a contract by the council for stringing aluminum cable and the installation of porcelain insulators at $42.50 per mile for cable and $1.50 per insulator.

Winnipeg, Man. — Officials of the Manitoba Electric Power Transmission Commission announce that it is estimated there will be expenditures in development work this year approximating $600,000, including the constructing of a power plant at Virden at an approximate cost of $75,000.

Woodstock, Ont.—The water and light commission has selected a site on Ingersoll avenue for the erection of a substation. Supplies, including switching apparatus and a transformer, will be purchased.

INCORPORATIONS

Milwaukee, Wis. — The M. & R. Manufacturing Co. has been incorporated with capital stock of $25,000 to manufacture machinery operated by electricity. Benjamin J. Morgan, Harriet E. Rundle and Edwin K. Rundle, 3524 Highland boulevard, are the incorporators.

Elgin, Ill. — The Elgin Machine Works has been incorporated with capital stock of $10,000 to manufacture automobile parts and farm implements. Martin Skok, Oscar Ludwig and Adam J. Stienke are the incorporators.

Toronto, Ont.—The Jones Motors, Ltd., has been incorporated with capital stock of $40,000 to manufacture motors, etc. William G. Jones, Wendell H. Osborne and others are the incorporators.

Toronto, Ont.—The Beatty McIntyre, Ltd., has been incorporated with capital stock of $100,000 to manufacture electrical appliances. Merril McDonald, G. W. Adams and Edwin Smily are the incorporators.

Toronto, Ont.—The Insulation and Moulded Products, Ltd., has been incorporated with capital stock of $80,000 to manufacture insulation material, etc. Alexander McKenzie, Alexander T. Davidson and others are the incorporators.

South Bend, Ind.—The Matthews-Banner Manufacturing Co. has been incorporated with capital stock of $200,000. Lewis C. Matthews, Walter A. Mortenson and others are the incorporators.

Cleveland, O. — The Lakewood Screw Machine Products Co. has been incorporated with capital stock of $10,000. M. Smith, K. G. Dean, H. G. Selby, F. W. Mould and S. A. Davies are the incorporators.

Merion, Pa.—The Philbrin Corp. Capital stock, $1,500,000. To manufacture starting and lighting systems. Incorporators: Rowland S. Phillips, Kennett Square; Firman S. Houston, Wayne; and H. Boardman Hopper, Merion.

Morgantown, W. Va.—The National Electric Service Co. Capital stock, $50,000. To operate an electric light and power system. Incorporators: Daniel A. Maurer, Walter E. Watkins and Dalton VanFleet, all of Fairmont, W. Va.

FOREIGN TRADE.

Electrical Apparatus (32,863)—An importer in Switzerland desires to secure an agency on a commission basis for the sale of electrical apparatus, agricultural machinery, tractors, automobiles, foodstuffs, hide and leather, hardware, metals, tires, and surgical tools and instruments. Correspondence may be in English.

Electrical Goods (32865)—An electric company in India desires to purchase and secure an agency for electric goods, such as wires, lamps 220-230-volt; table fans 12-in., and 16-in., alternating current, oscillating and other; and electrical fancy goods; hosiery, stationery, and fancy goods. Quotations should be given c. i. f. Karachi. Terms, credit on large orders, and cash for small orders.

Electrical Goods (3289)—A merchant firm in Brazil desires to purchase and secure an agency for hardware, ironware, cement, coal, chemicals, dyes, cotton goods, chinaware, and glassware, arms and ammunition, electrical fittings, lamps, paper and stationery, paints and varnishes, sugar-mill machinery, agricultural implements, automobiles and trucks, and preserves. Quotations should be given c.i.f. Brazilian port. Usual 90 days' credit terms desired.

PROPOSALS

ELECTRICAL WORK—Sealed proposals will be opened in the office of the supervising architect of the United States Treasury Department, Washington, D. C., at 3 p. m., June 28, 1920, for furnishing materials and labor for the construction of officers' quarters, for the United States Marine Hospital, San Francisco, Cal., including material for concrete, sheet metal work, ceramic tile, lumber, mill-work, painting, hardware, plumbing, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto, copies of which may be obtained from the supervising superintendent of construction, room 403, post office and court house, San Francisco, Cal., or at the office of Jas. A. Wetmore, acting supervising architect, Washington, D. C.

Advertising and Good Will

I am in receipt of a very interesting letter from Mr. Chas. A. Otis of Otis & Co., investment bankers, Cleveland, O., in which he comments on an article which recently appeared in ELECTRICAL REVIEW under the heading, "Good Will as a Basis of Credit." Mr. Otis says:

> **"I think there can be no question of the great part which good-will today plays as a basis of credit, nor that the part which advertising in the broadest interpretation of the word may play in building up good-will, is only beginning to be thoroughly appreciated.**
>
> **"Some appreciation of its tremendous importance not only as a selling medium but as a constructive force in our national life, can be gained from a realization of the fact that to a very large degree today the education of our people, in matters not touching their individual tasks, is derived from the printed word as set forth in advertising.**
>
> **"I feel, therefore, that too much stress cannot be laid upon this subject. I have chosen to bring my comment to bear more upon the question of advertising than upon that of good-will, because I feel so strongly on the subject that I cannot overlook an opportunity to emphasize what I consider its basic importance."**

Since writing the above Mr. Otis has been elected President of the Associated Advertising Clubs of the World, in a meeting held last week at Indianapolis, which was attended by over 5000 delegates from all of the English speaking countries. This honor came to him entirely unsought and was a spontaneous expression of the appreciation felt for the consistent, constructive attiude which Mr. Otis has maintained for many years past on the subjects mentioned above. Mr. Otis has played a leading part in the upbuilding of business and he is in a position to state with more than ordinary authority what factors are most valuable in doing so. His judgment, therefore, is one to be respected and followed.

C. A. TUPPER, PRESIDENT,
INTERNATIONAL TRADE PRESS, INC.,
CHICAGO.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Connecticut Power Co. Increases Capital Stock.

The Connecticut Power Co. has increased its capital stock from $1,500,000 to $3,750,000, the issue being divided into 12,500 shares of preferred stock of the aggregate value of $1,250,000, and 25,000 shares of common stock of the aggregate value of $2,500,000. This increase is subject to further increase in accordance with the terms of the consolidation agreement of March 25, 1913, between the Connecticut Power Co. and the New London Gas & Electric Co. The increase amounts to 15,000 shares of an aggregate par value of $1,500,000 on the capital stock now outstanding, or to an increase of 3500 shares of the aggregate par value of $350,000 on the capital stock as fixed by the consolidation agreement.

Montana Power Co. Surplus for Four Months Is $1,312,743.

The consolidated income account of the Montana Power Co. for the four months ended April 30, 1920, shows surplus after taxes and charges of $1,312,743, equivalent after preferred dividends to $2.63 a share earned on the $43,407,500 dividend bearing stock. The statement follows:

Gross earnings	$2,765,950
Net after taxes	1,891,610
Other income	3,270
Net income	$1,894,880
Interest and construction	582,137
Surplus income	$1,312,743
Preferred dividends	169,256
Common dividends	325,556
Surplus	$ 817,931
Profit and loss surplus	4,158,954

United Light & Railways Co. and Subsidiaries.

(Twelve months ended April 30, 1920.)

	1920.	1919.
Twelve months' gross	$10,700,220	$9,659,547
Net after taxes	3,074,593	2,859,574
Surplus after charges	1,254,902	1,116,730
Balance after preferred dividends	650,963	509,658

International Railway Co.

(Three months ended March 31, 1920.)

	1920.	1919.
Gross earnings	$2,418,022	$2,147,287
Net earnings	482,641	352,985
Total income	330,273	225,408
Surplus after charges	212,989	77,823

Duquesne Light Co. and Subsidiaries.

	1920.	1919.
April gross	$1,155,338	$1,037,495
Net after taxes	335,600	389,684
Four months' gross	4,981,756	4,225,965
Net after taxes	1,714,498	1,623,178

American Power & Light Co. Subsidiaries.

	1920.	1919.
April gross	$1,660,116	$1,252,607
Net earnings	626,456	459,964
Twelve months' gross	17,778,040	14,576,616
Net earnings	6,796,821	5,470,654

Republic Railway & Light Co. and Subsidiaries.

	1920.	1919.
April gross	$ 659,568	$ 493,363
Net after taxes	155,384	115,775
Total income	182,184	147,829
Surplus after charges	61,754	33,793
Balance after preferred dividends	35,797	7,836
Twelve months' gross	6,916,361	5,704,956
Net after taxes	1,726,706	1,364,783
Total income	1,902,517	1,575,267
Surplus after charges	506,750	262,811
Balance after preferred dividends	195,267	*48,672

*Deficit.

General Gas & Electric Co. Subsidiaries.

	1920.	1919.
April gross	$ 851,270	$ 694,885
Net after taxes	206,588	215,533
Twelve months' gross	9,762,532	8,314,316
Net after taxes	2,693,629	2,294,109

Portland Railway, Light & Power Co.

	1920.	1919.
April gross	$ 738,752	$ 706,244
Net after taxes	219,631	282,314
Surplus after interest charges	29,260	90,034
Twelve months' gross	8,717,040	8,095,204
Net after taxes	2,913,874	2,668,407
Surplus after interest charges	639,598	414,007

Nashville Railway & Light Co.

	1920.	1919.
April gross	$ 315,116	$ 264,051
Net after taxes	69,960	67,991
Surplus after interest charges	30,087	28,336
Twelve months' gross	3,388,042	3,081,964
Net after taxes	794,757	927,421
Surplus after interest charges	194,011	324,543

Texas Power & Light Co.

	1920.	1919.
April gross	$ 331,387	$ 259,377
Net after taxes	106,299	77,342
Total income	106,988	78,824
Surplus after interest charges	50,959	24,343
Twelve months' gross	3,735,958	3,353,830
Net after taxes	1,274,164	1,080,888
Total income	1,281,617	1,084,585
Surplus after interest charges	624,581	408,251
Balance after preferred dividends	376,081	159,751

Pennsylvania Utilities System.

	1920.	1919.
March gross	$169,614	$138,007
Net after taxes	42,253	38,581

Utah Power & Light Co.

	1920.	1919.
April gross	$ 531,390	$ 438,601
Net after taxes	253,040	221,865
Total income	263,949	230,467
Surplus after charges	123,735	88,975
Twelve months' gross	5,997,412	5,624,762
Net after taxes	2,860,387	2,960,379
Total income	2,982,399	3,091,390
Surplus after charges	1,323,866	1,362,798
Balance after preferred dividends	737,003	837,103

Adirondack Electric Power Corp.

	1920.	1919.
April gross	$ 166,504	$ 133,574
Net after taxes	88,124	54,395
Surplus after charges	60,090	33,234
Twelve months' gross	1,901,165	1,795,346
Surplus after charges	367,860	190,115
Net after taxes	687,230	452,696

Eastern Pennsylvania Railways Co.

	1920.	1919.
April gross	$ 158,075	$ 129,172
Net after taxes	52,732	40,542
Total income	53,414	40,876
Surplus after charges	28,551	16,341
Twelve months' gross	1,741,056	1,330,004
Net after taxes	461,567	316,196
Total income	471,612	330,919
Surplus after charges	174,657	47,809

Dividends.

The Standard Gas & Electric Co. has declared its regular dividend of 2% on its preferred stock, payable June 15 to stockholders of record May 29.

The Arkansas Valley, Light & Power Co. has declared its regular quarterly dividend of 1¾% on the preferred stock, payable June 15 to stockholders of record May 29.

The Oklahoma Gas & Electric Co. has declared its regular quarterly dividend of 1¾% on its preferred stock, payable June 15 to stockholders of record May 29.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid June 8.	Bid June 15.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	10	10
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	98	105
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	139	135
American Light & Traction of New York, preferred	6	80	80
American Power & Light of New York, common	4	50	50
American Power & Light of New York, preferred	6	65	65
American Public Utilities of Grand Rapids, common	..	4	4
American Public Utilities of Grand Rapids, preferred	7	13	12
American Telephone & Telegraph of New York	..	102	103
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	6	5
American Water Works & Elec. of New York, first preferred	..	37	36
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	14	15
Cities Service of New York, common	+extra	330	325
Cities Service of New York, preferred	6	65	64
Commonwealth Edison of Chicago	8	102	100
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	39	39
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	41	41
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	31	33
Northern States Power of Chicago, common	..	36	35
Northern States Power of Chicago, preferred	ex.div.7	77	78
Pacific Gas & Electric of San Francisco, common	..	58	58
Public Service of Northern Illinois, Chicago, common	7	76	76
Public Service of Northern Illinois, Chicago, preferred	6	79	79
Standard Gas & Electric of Chicago, common	..	13	13
Standard Gas & Electric of Chicago, preferred	6	36	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3	3
United Light & Railways of Grand Rapids, common	4	18	18
United Light & Railways of Grand Rapids, preferred	6	55	55
Western Power of San Francisco, common	..	14	14
Western Union Telegraph of New York	extra	82	82
Industrials—			
Electric Storage Battery of Philadelphia, common	4	103	103
General Electric of Schenectady	8	180	178
Westinghouse Electric & Mfg. of Pittsburgh, common	7	55	54

Contractor-Dealer Issue

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

Vol. 76. CHICAGO, SATURDAY, JUNE 26, 1920. No. 26.

The Week's News in Brief

For Busy Readers

New York State Contractor-Dealers Meet.—The annual convention of the New York State Association of Contractors and Dealers was held at Utica, N. Y., June 24-25, with a large attendance of delegates from all parts of the state.

Electrical Exports Fall Off in April.—Electrical exports for April, as compiled by the United States Bureau of Foreign and Domestic Commerce, totaled $6,954,350, or $777,691 for April, 1919, when the total exports amounted to $7,732,941.

Iowa Section, N. E. L. A., Holds Convention.—The nineteenth annual convention of the Iowa Section of the National Electric Light Association was held in Colfax, Ia., June 23-25. A full report of the convention will be given in next week's issue.

Chicago Street Railways Get Higher Fare.—The Public Utility Commission of Illinois has granted an eight-cent rate of fare to the Chicago surface street car lines, effective July 1. The increase is a temporary one until such time as the commission can determine what permanent rate is necessary to allow the company to operate.

President Wilson Signs Water-Power Bill.—It was announced at the White House that President Wilson had signed the water-power bill. The measure was passed on the final day of Congress and the President affixed his signature to it under a ruling by Attorney-General Palmer that he had until 10 days after the adjournment of Congress to act.

Restoration of Credit Electric Railways' Task.—John H. Pardee, president of the American Electric Railway Association, in an interview declared that the restoration of credit was the principal task of the electric railways at the present time.

Wireless Telephony to Aid Talking Moving Pictures.—A report from France is to the effect that a French expert, who is unnamed, has devised a method whereby wireless telephony will be used to make perfect the manufacture of talking moving pictures.

Chicago Civic Organizations Appeal for Utilities Relief.—A petition signed by eight civic clubs and business organizations of Chicago was presented to the Illinois Public Utility Commission last week asking that necessary relief in the way of increased rates be given the public utilities of Chicago and vicinity.

Pennsylvania Contractors Hold Meeting.—A large attendance marked the electrical "get-together" meeting of the Pennsylvania State Association of Electrical Contractors and Dealers, held at Pittsburgh, June 23-24. Addresses were made by William L. Goodwin, Samuel A. Chase, H. B. Kirkland and others.

Invents Device to Transmit Pictures by Wire.—T. H. Anderson, of Copenhagen, Denmark, is said to have invented a device which enables the transmission of pictures and sketches by cable or wireless over long distances. It is said that any wireless telegraph or telephone system can be used and that the cost of working it is low.

ANACONDA COPPER WIRE

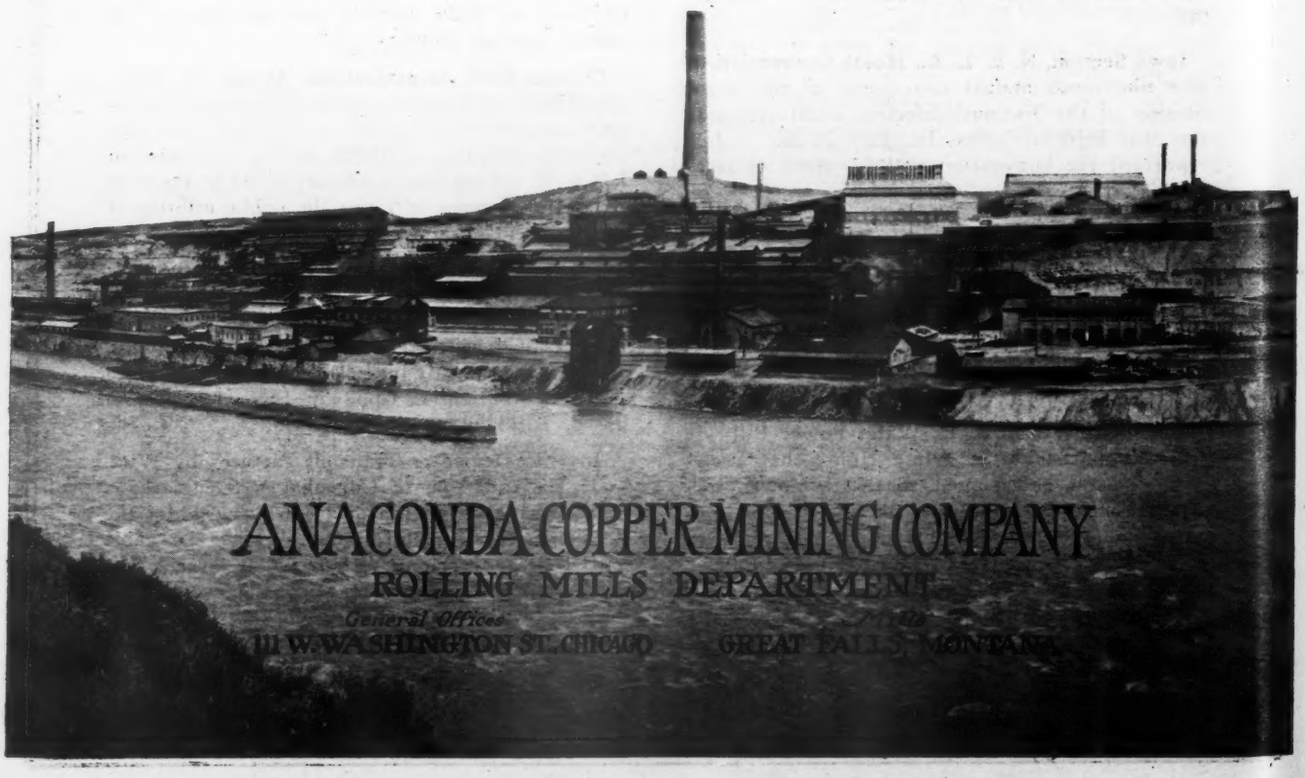
Copper wire depends on the purity of the copper and on the method of drawing for its quality.

Anaconda copper wire is made from B. & K. brand electrolytic copper, of an average conductivity of 100.75% Mathiessen's Standard and a metallic impurity content of less than 1/100 of 1%.

Anaconda's wire drawing methods are most up to date. Every step in the manufacturing process is carefully checked by rigid self imposed tests.

ANACONDA

from ore to finished product



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CHARLES W. PRICE, *Editor.*

FRED T. BANGS, *Managing Editor.*

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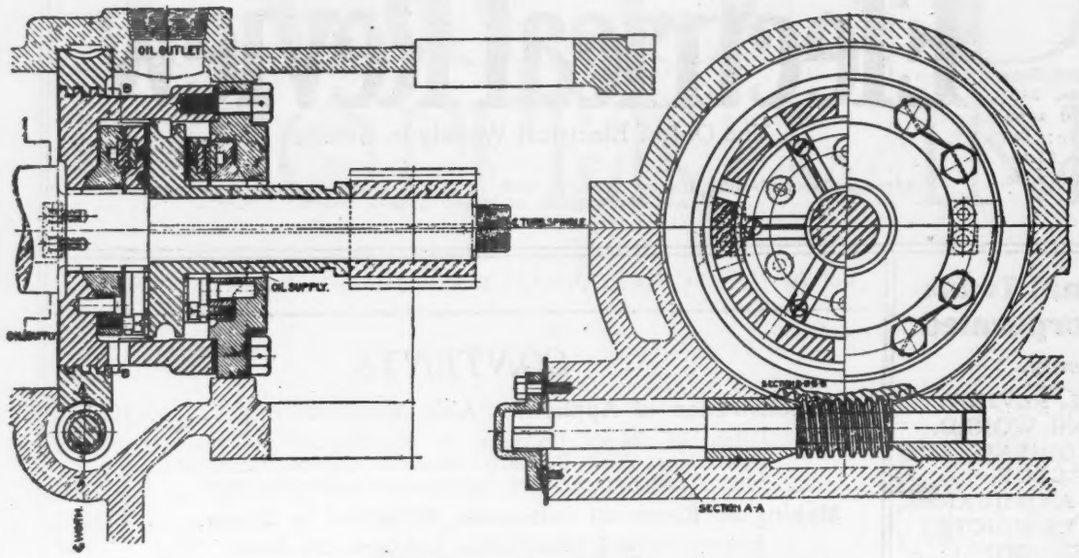
Reliable, and Why—



The Kingsbury thrust bearing carries enormous loads per square inch of area because of the self-adjusting segments which set themselves at an angle with the plane of the thrust disc, corresponding to the thinning of the oil film as it is squeezed between the surfaces.

End Thrust—

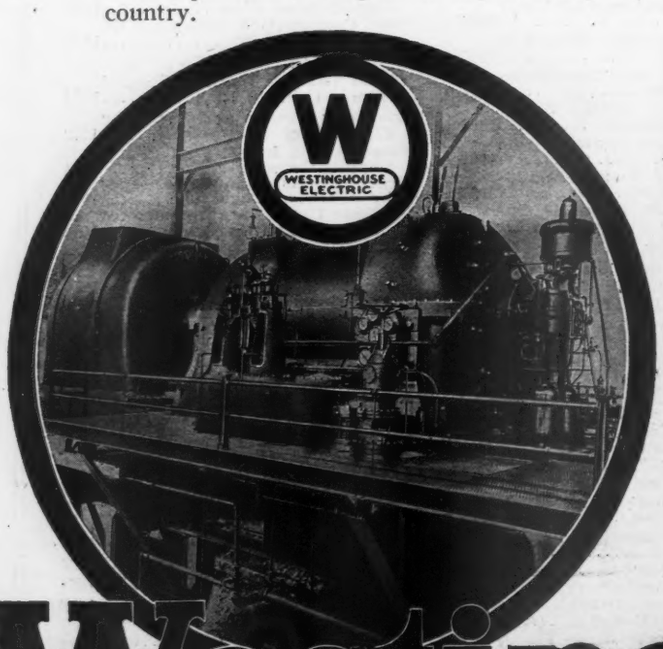
And The Kingsbury Thrust Bearing

Advertisement No. 5—Feature No. 5.

The strictly double-flow turbine, in which the steam divides equally and flows in both directions from the center, has no end thrust.

Other designs have end thrust, and means must be provided to counter-act the thrust so that the rotor will remain in its correct axial position.

The Kingsbury Thrust Bearing, used on all Westinghouse turbines in which there is end thrust, possesses a degree of dependability exceeding any construction ever employed in this country.



500 lbs. per sq. in. may be carried indefinitely.

5000 lbs. per sq. in. have been carried experimentally.

Installed on the Westinghouse Steam Turbine, the pressure commonly carried is about 300 lbs. per sq. in.

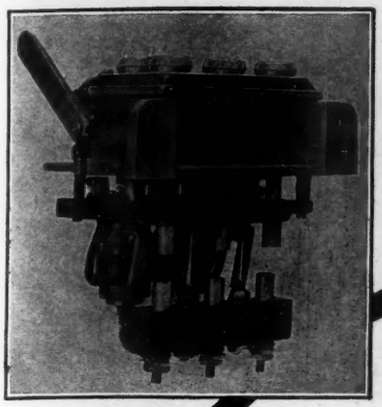
The illustration shows the construction of this bearing.

The extraordinary ruggedness and reliability of the Westinghouse Steam Turbine are due to the thoroughness with which every detail has been carried out and the large factor of safety employed in its design.

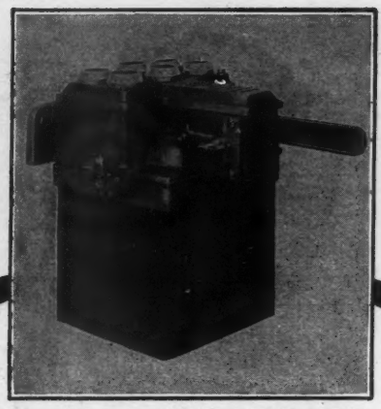
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

Westinghouse

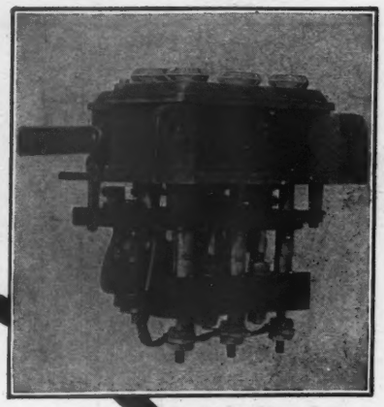
For Industrial Service



Tank Removed Open.



Three-Pole Indoor Wall-Mounting Type H Oil Circuit Breaker, Plain Automatic Overload, or Plain Undervoltage Trip.



Tank Removed Closed.

Westinghouse Type H Oil Circuit Breaker

A simple but reliable low priced, Oil Circuit Breaker of considerable interrupting capacity, for use on Industrial Circuits.

These breakers are used on branch feeders for automatic control, and protection against heavy overloads and short circuits, in connection with other motor starting devices.

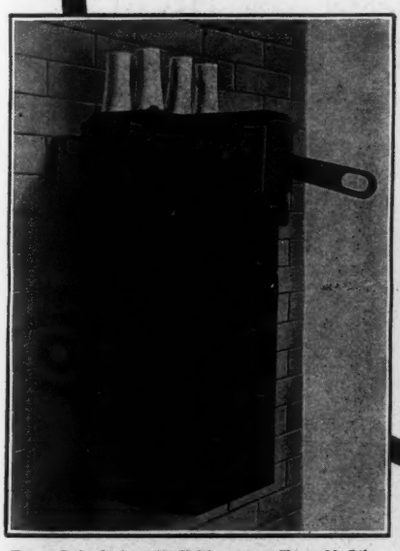
As motor starters, they combine full automatic overload trip, inverse time limit and undervoltage release protection with the interrupting capacity of a circuit breaker.

For voltages up to 2,500 alternating current, capacities up to 100 amperes.

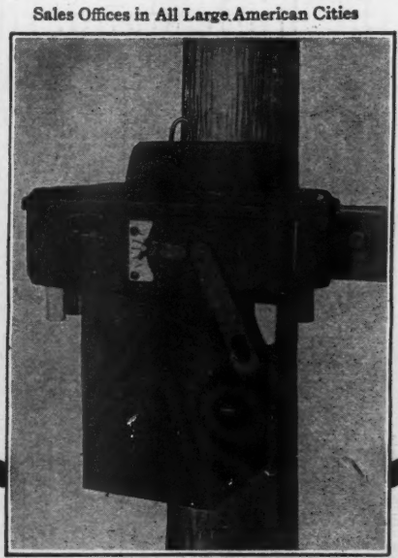
Full description in Miniature Catalogue 1-C-1

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

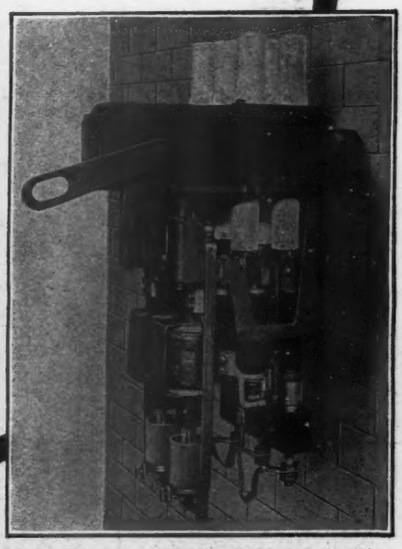
Sales Offices in All Large American Cities



Three-Pole Indoor Wall-Mounting Type H Oil Circuit Breaker, Full Automatic Overload Trip, and Adjustable Inverse Time Element.



Three-Pole, Weatherproof, Outdoor Mounting Type H Oil Circuit Breaker, Undervoltage and Full Automatic Overload Trip, with Adjustable Inverse Time Element.



Three-Pole Indoor Wall-Mounting Type H Oil Circuit Breaker, Full Automatic Overload and Adjustable Inverse Time Element. Tank Removed.

Westinghouse

Flexibility

On Wood Molding

On Metal Molding

On Pipe Taplets

No. 50724

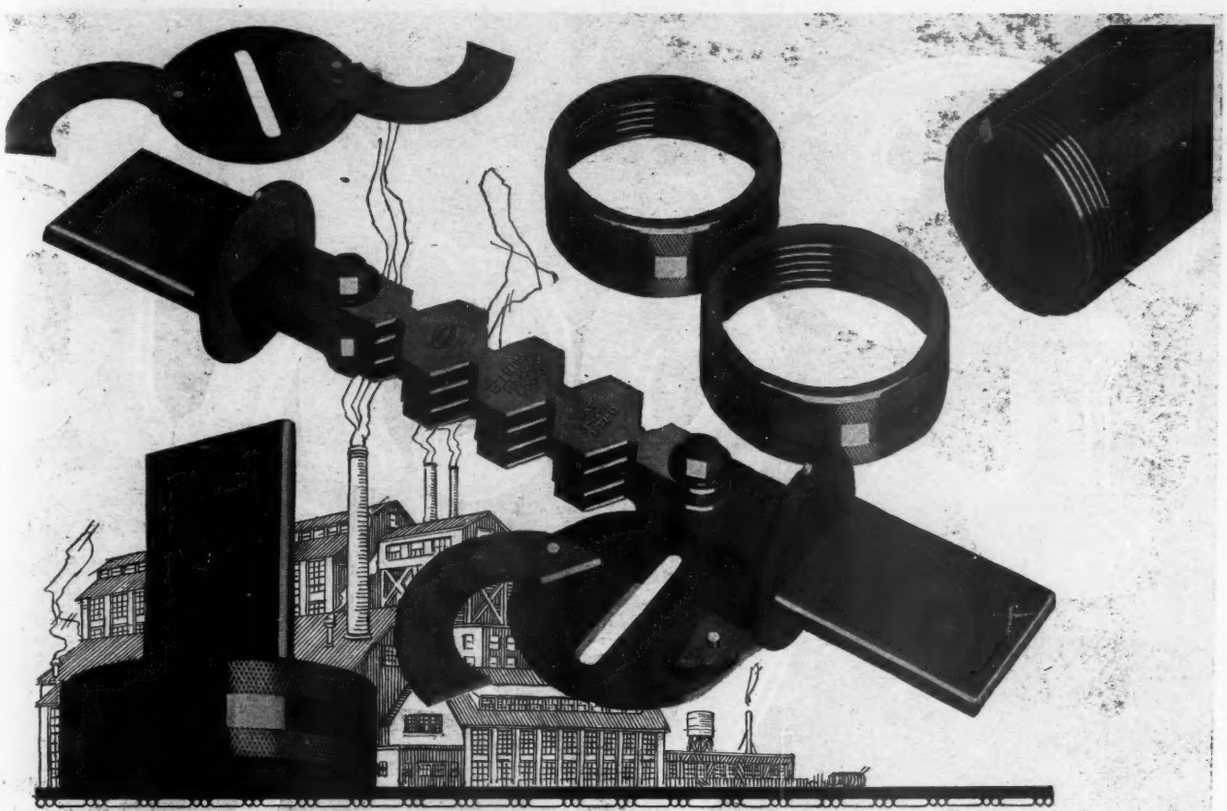
THE "Paiste" line of Wiring Materials is so extensive, so complete, that it can be adapted to meet every requirement of architect or electrical contractor. Wherever high grade work is to be done, there "Paiste" Wiring Materials will give the best service.

For a quarter century "Paiste" Wiring Materials and "H & H" Switches have never fallen below the high standard set for them at the outset. And this standard has steadily risen during the years.

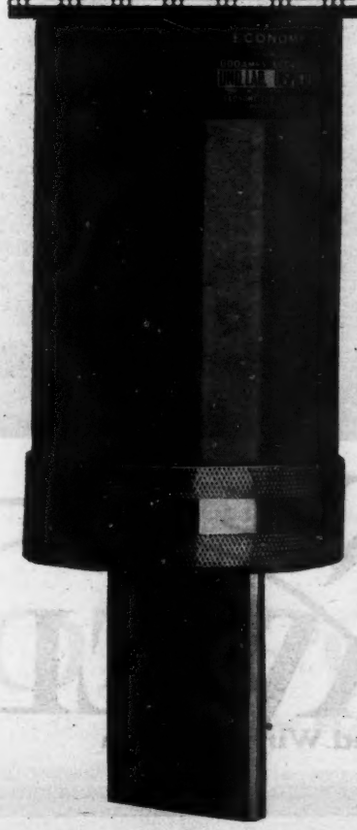
THE HART & HEGEMAN MFG. CO.
Hartford, Conn. U. S. A.

"PAISTE"
Wiring Materials

20-27



ECONOMY *renewable* FUSES



have for years cut 80% out of the annual fuse maintenance costs of all industries using electrical energy.

The simple, accurately rated, inexpensive Economy "Drop-Out" Renewal Link is easily and quickly replaced when a fuse is blown.

In the higher capacity fuses, multiple Economy "Drop-Out" Renewal Links are used, as shown in the illustration.

The Winged Washer adds to the ease and convenience of renewing the fuse.

Extra heavy brass end caps, knurled and threaded, complete the fuse assembly.

ECONOMY renewable FUSE was the first fuse using an inexpensive bare renewal link for restoring a blown fuse to its original efficiency to gain full Underwriters' Approval IN ALL CAPACITIES.

Buy Economy Fuses and Economy "Drop Out" Renewal Links from leading electrical jobbers and dealers

ECONOMY FUSE & MFG. CO.

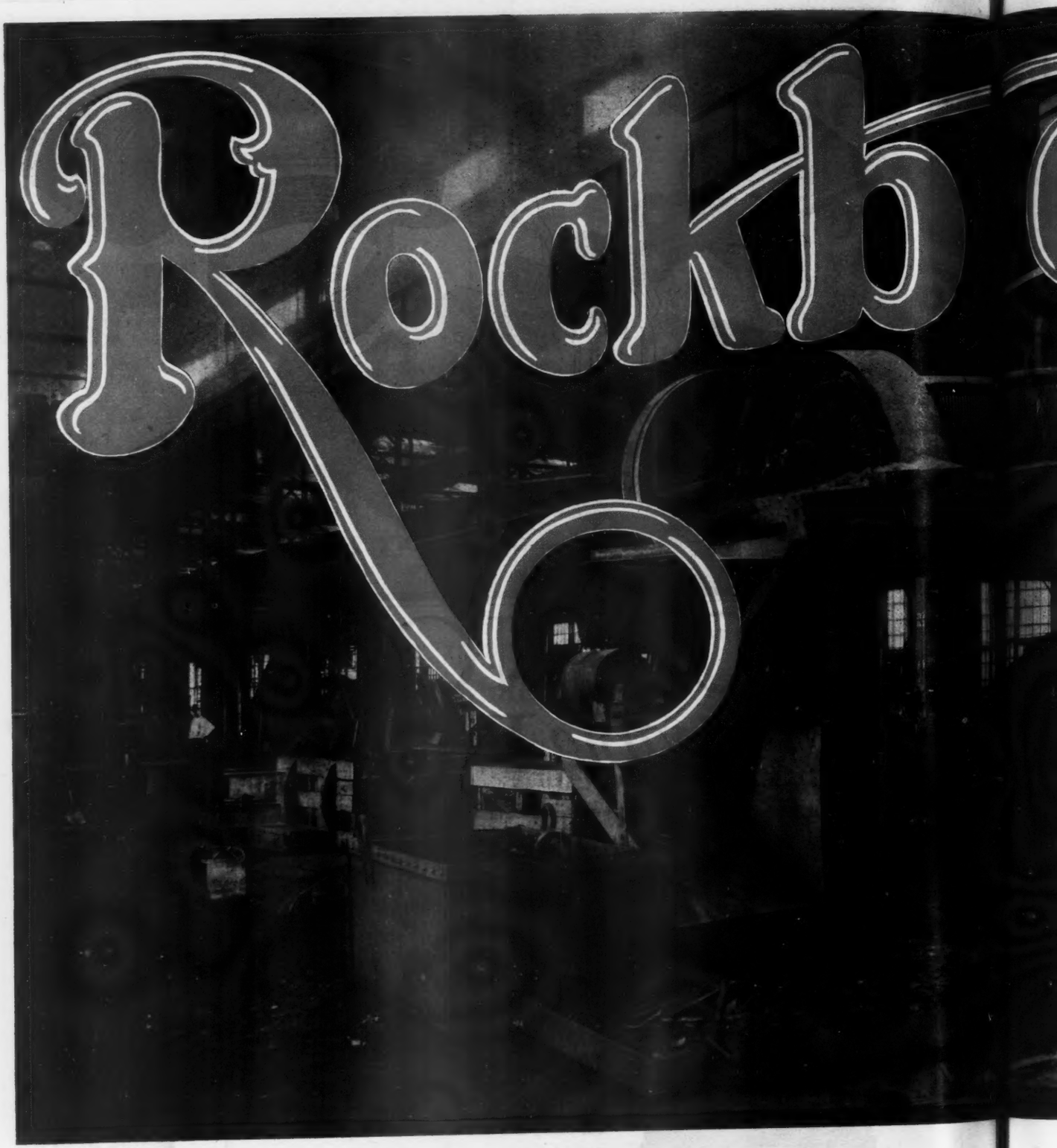
CHICAGO, U. S. A.

Economy Fuses are also made in Canada at Montreal

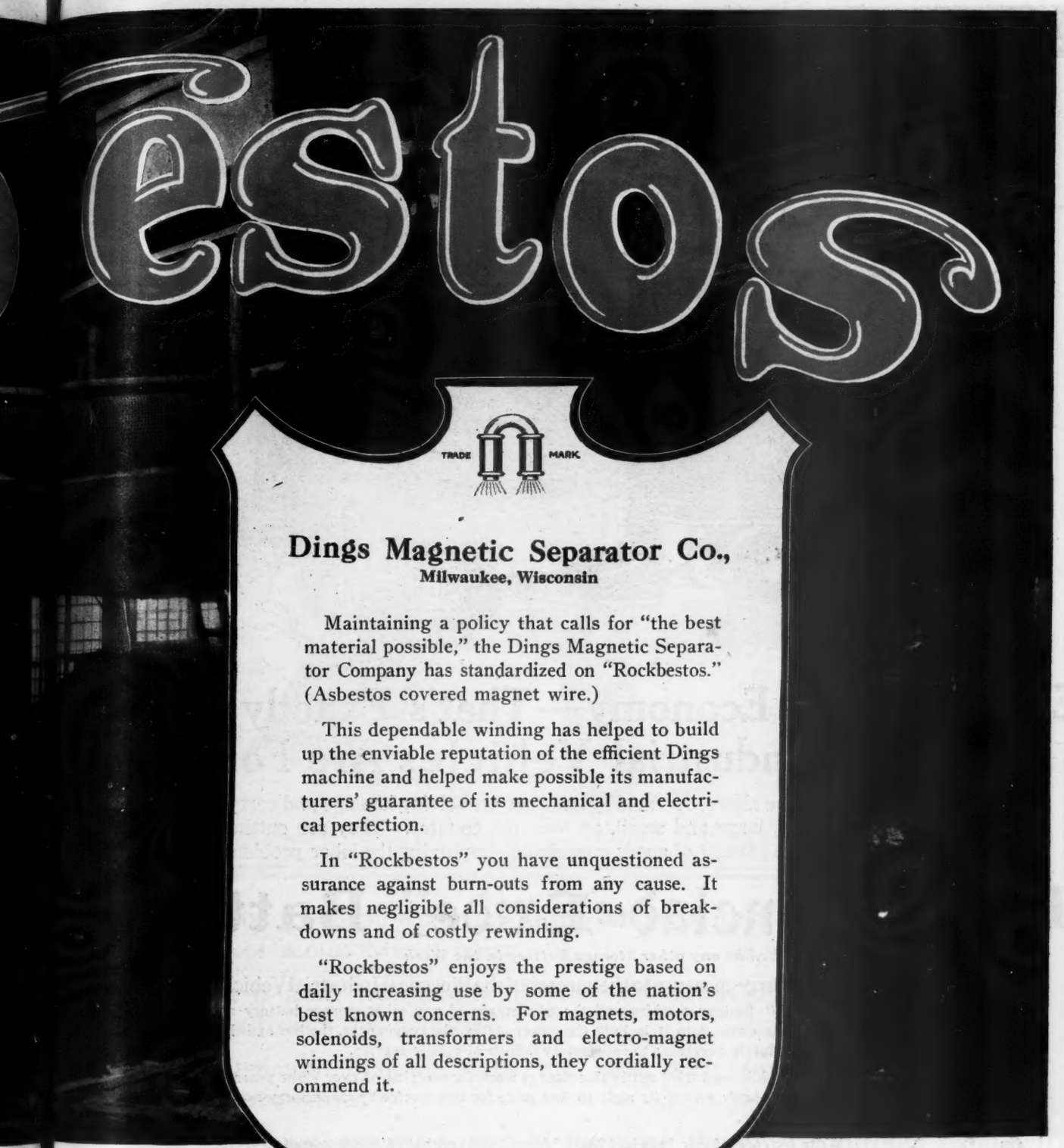
Insist on these marks of official approval:

The symbol on the link

The label on the fuse



MARLIN ROCKWELL
Insulated Wire Division



Dings Magnetic Separator Co.,
Milwaukee, Wisconsin

Maintaining a policy that calls for "the best material possible," the Dings Magnetic Separator Company has standardized on "Rockbestos." (Asbestos covered magnet wire.)

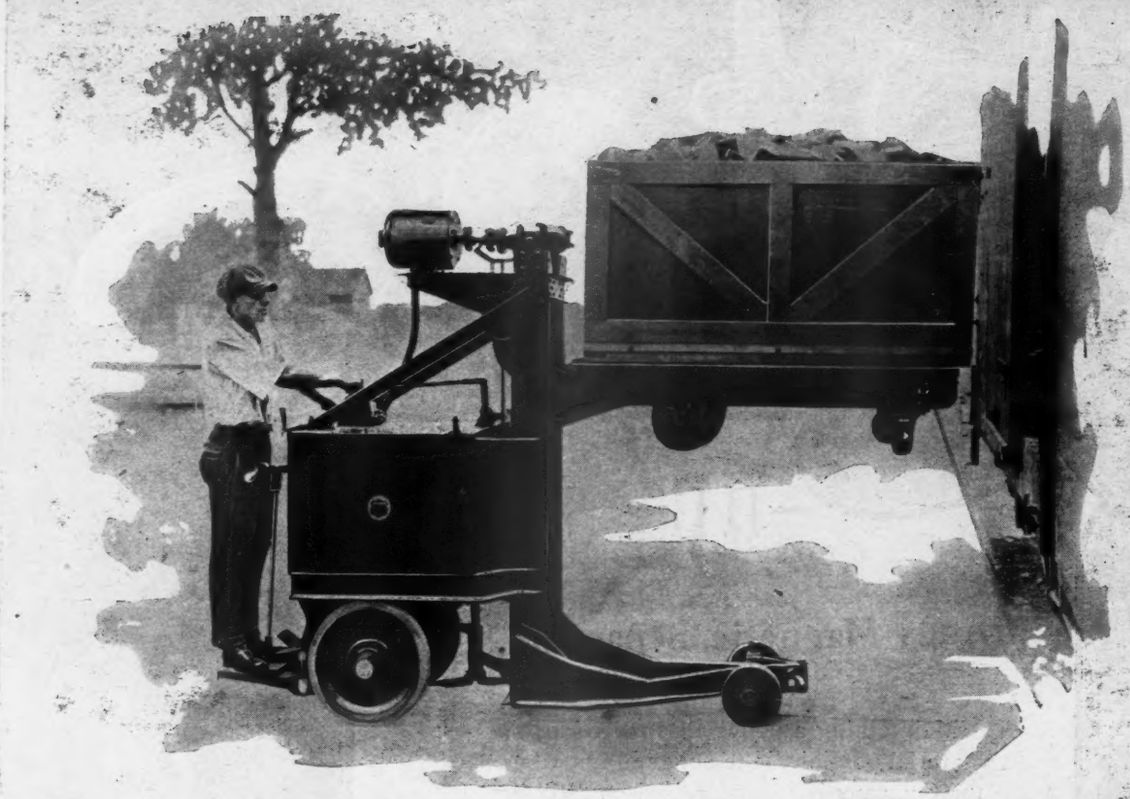
This dependable winding has helped to build up the enviable reputation of the efficient Dings machine and helped make possible its manufacturers' guarantee of its mechanical and electrical perfection.

In "Rockbestos" you have unquestioned assurance against burn-outs from any cause. It makes negligible all considerations of breakdowns and of costly rewinding.

"Rockbestos" enjoys the prestige based on daily increasing use by some of the nation's best known concerns. For magnets, motors, solenoids, transformers and electro-magnet windings of all descriptions, they cordially recommend it.

CORPORATION
NEW HAVEN, CONNECTICUT

THE ELECTRIC STORAGE BATTERY CO.



Efficiency and Economy—That's Exactly What Electric Industrial Vehicles Are For

Such machines as the above, operated by one man, are solving haulage and carrying problems today, large and small, all over the country. They are cutting costs, increasing the amount of goods moved and simplifying the labor problem.

The "Ironclad-Exide" Battery

Unlike any other Storage Battery in the Work

has contributed in a large measure to the success of the Electrical Industrial Vehicle.

The **"Ironclad-Exide"** Battery combines all the advantages of any other storage battery as well as advantages of its own. Into it is built the power-ability, the ruggedness, the life and the efficiency which are absolutely necessary to satisfactory industrial vehicle service.

The **"Ironclad-Exide"** has been tried out in this class of work for a period of over eight years—it has *absolutely proved its right* to first place for this service by its performance in actual service.

Write for copy of our booklet "Facts," from 1874, and list of truck manufacrurers.

The famous "Ironclad-Exide" Positive Plate
Different from every other battery plate in the world

THE ELECTRIC STORAGE BATTERY CO.

The largest manufacturer of storage batteries in the world
1888 PHILADELPHIA, PA. 1920

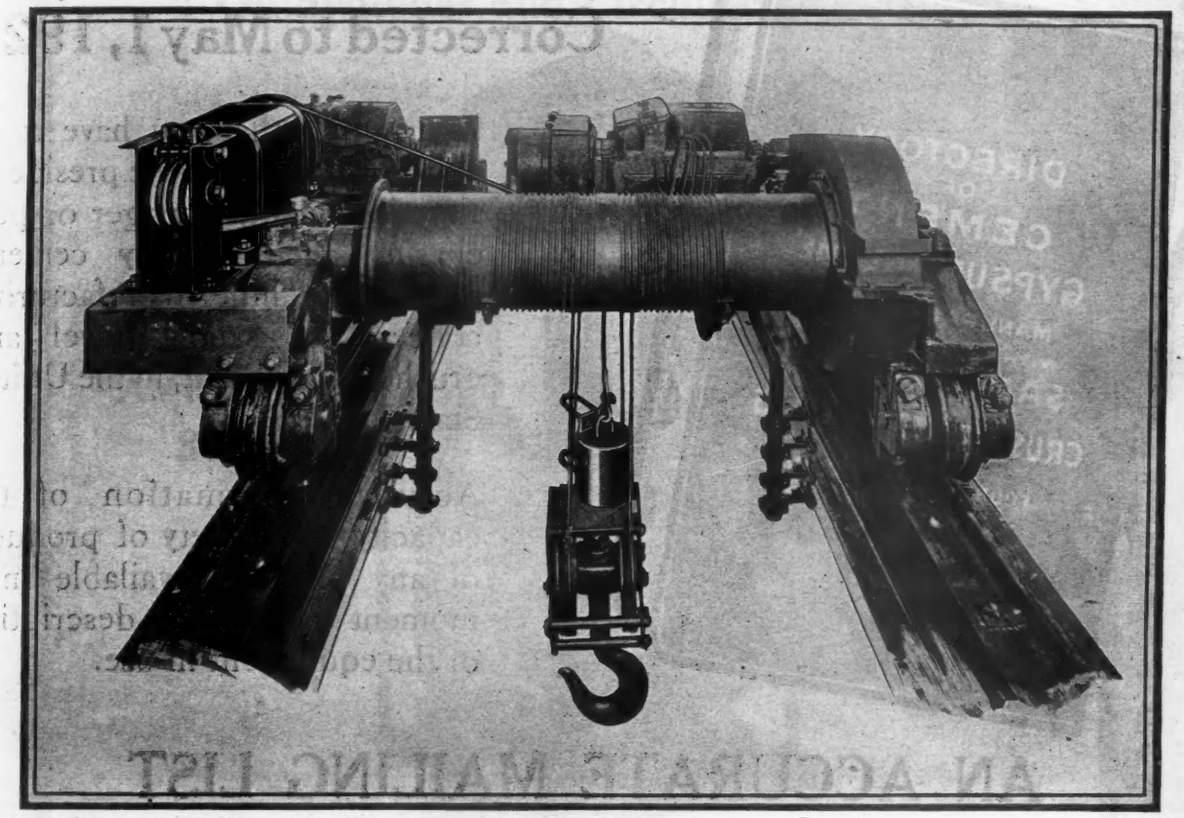
New York Boston Chicago Washington Denver San Francisco St. Louis
Minneapolis Cleveland Atlanta Kansas City Pittsburgh Detroit Rochester

Special Canadian Representatives; Chas. E. Goad Engineering Co., Ltd., Toronto and Montreal

Batteries are made by this Company for every storage battery purpose

THE ELECTRIC STORAGE BATTERY CO.

Youngstown Safety Limit Stop



The Youngstown Safety Limit Stop is used to prevent the over travel of motor driven hoists.

It is built for hard work and thousands are installed in steel mills all over the country.

Dynamic braking stops the hook with *any load* at *any speed* within *six inches.*

It is automatically reset by throwing the hoist controller handle to the "down" direction.

Write for Bulletin 1040-A

THE ELECTRIC CONTROLLER & MFG. CO.

NEW YORK-50 CHURCH ST. PITTSBURG-OLIVER BLDG. BIRMINGHAM-BROWN-MARX BLDG. SAN FRANCISCO-CALL BLDG. LOS ANGELES-O.E.THOMAS, WASHINGTON BLDG. SEATTLE-524 1ST. AVE. SOUTH DENVER AND SALT LAKE CITY-O. H. DAVIDSON EQUIPMENT COMPANY.

CLEVELAND, OHIO.

CHICAGO-CONWAY BLDG. DETROIT-DIME BANK BLDG. TORONTO-TRADERS BANK BLDG.

READY NOW!

The New Directory
Corrected to May 1, 1920

So arranged that you have in an instant the name of the president, superintendent, manager or purchasing agent of any cement, gypsum or lime manufacturing concern or sand, gravel and crushed stone plant, in the United States or Canada.

Accurate information of the capacity and variety of products of any plant is available in a moment with a brief description of the equipment in use.

AN ACCURATE MAILING LIST

The Fourteenth Edition, 1920 Directory of Cement, Gypsum and Lime Manufacturers is pocket size, leather bound.

It contains 460 pages of addresses, production data, and equipment in use by every producer in the United States or Canada as well as a host of other valuable information arranged in a manner that makes it instantly available.

It presents a handy ready reference use for salesmen.

The information given covers:
Cement Mills and Their Locations; Officers and Department Heads of Cement Companies; Cement Brands; Gypsum and Lime Manufacturers; Sand, Gravel and Crushed Stone Producers, covering Limestone, Basalt, Sandstone and Granite; Miscellaneous Stone Quarries; Complete Buyers' Guide of Machinery and Supplies, and Other Indispensable Data.

This is the most complete and accurate Directory issued.

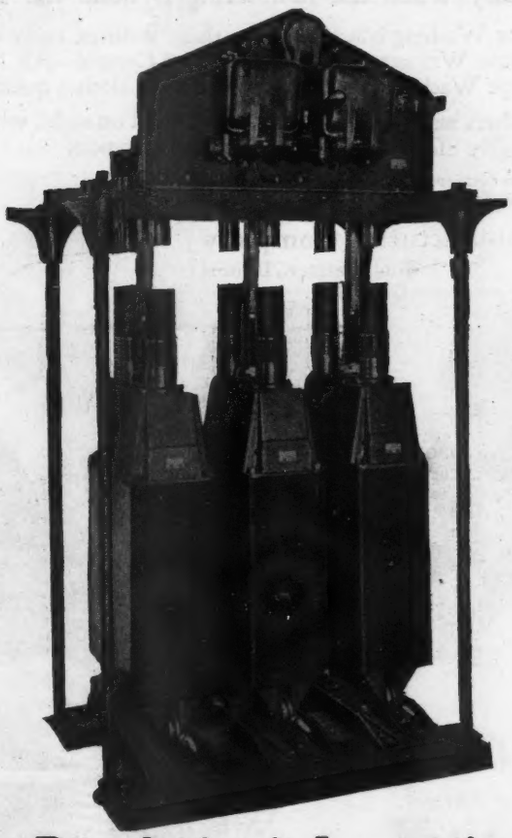
The 1920 Edition, Directory of Cement, Gypsum and Lime Manufacturers will be sent post-paid to any address at $2.50 each. Send in your order for the number required that they may be sent among the first.

INTERNATIONAL TRADE PRESS, Inc., 542-55 Monadnock Block CHICAGO

CONDIT

TYPE F-6

Oil Switches and Circuit Breakers



AMPERES
800

VOLTS
15,000

Its Popularity is Increasing

Facilitates inspection and reduces time of interruptions to a minimum. The units are rigidly built, compact and interchangeable.

The high speed of operation and high head of oil overbreak makes the type F-6 an ideal switch for heavy duty.

Furnished complete with framework. See Bulletin 435.

Condit Electrical Mfg. Co., South Boston, Mass.

Manufacturers of Electrical Protective Devices

Akron, Ohio. Albany, N. Y. Buffalo, N. Y. Charlotte, N. C.
Chicago, Ill. Cincinnati, Ohio Cleveland, Ohio. Dallas, Texas. Detroit, Mich.
Jacksonville, Fla. Kansas City, Mo. Los Angeles, Calif. Miami, Fla. Minneapolis, Minn.
New Orleans, La. New York City, N. Y. Philadelphia, Pa. Pittsburgh, Pa. San Francisco, Calif.
Seattle, Wash. St. Louis, Mo. Salt Lake City, Utah. Washington, D. C. Youngstown, Ohio.

Northern Electric Company
LIMITED

Montreal Halifax Ottawa Toronto Winnipeg Regina
London Vancouver Calgary Edmonton

The Synonym of Safety in Electrical Protective Equipment

Meadows Washers Make Happy Families

The ease, speed and efficiency with which a Meadows Power Washing Machine does the week's washing not only makes Mother happy—it makes the whole family feel better. Laundering clothes to snowy whiteness is easy when the laundering is done the Meadows way.

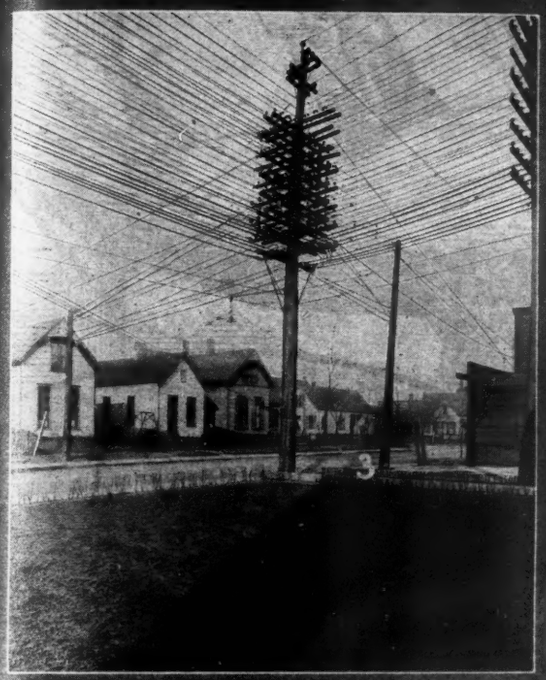
Meadows Power Washing Machines have these features, many of them exclusive: Swinging Reversible Wringer—Foot Pedal Safety Control—All Moving Parts Enclosed—Dolly Type Washing Principle which washes clothes quicker, cleaner, better.

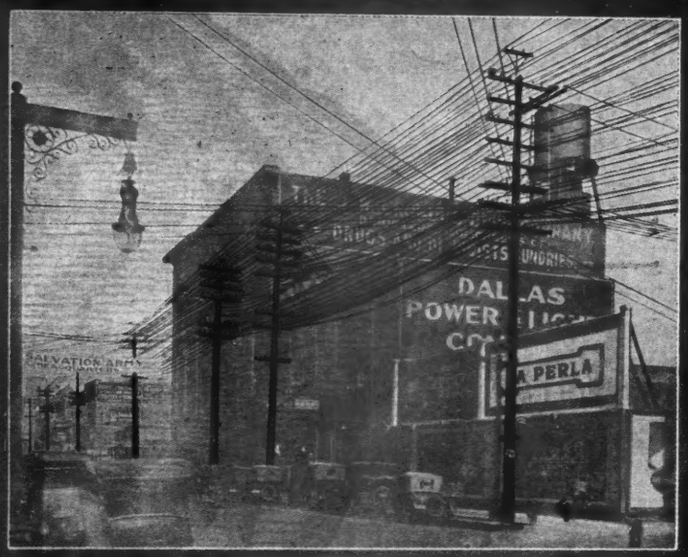
Meadows Washers make happy dealers. They sell on sight, which means a quick turnover. They give lifelong satisfaction to your customers.

Supplied for either electric or belt power. Write for descriptive literature and dealer proposition.

Meadows Manufacturing Company
30 Bell Street **Bloomington, Illinois**

Cut Maintenance Costs by having Northern White Cedar Poles





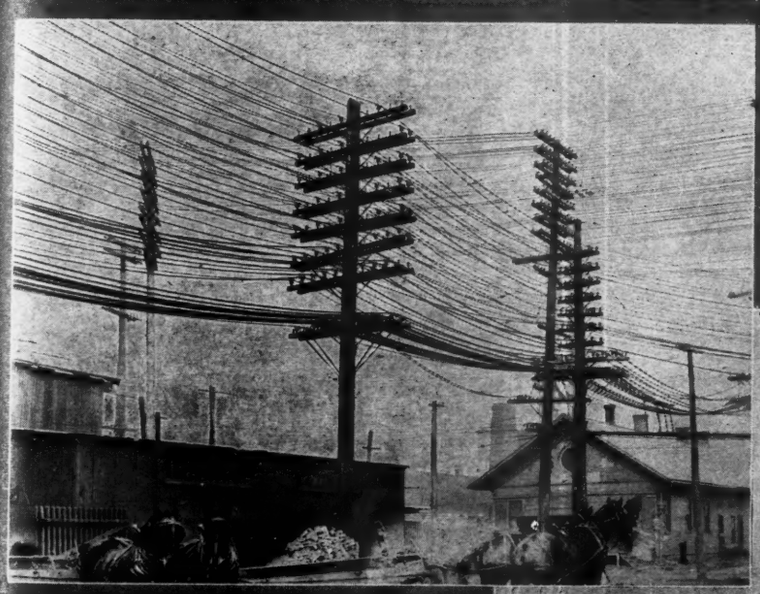
The nation over, Northern White Cedar Poles have proved to be the basis for economy in pole line construction.

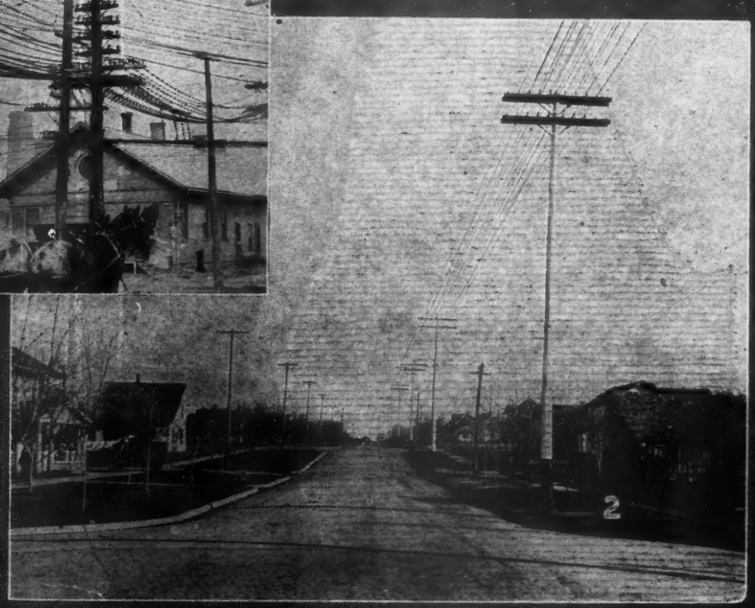
They are light, easily handled and transported, reducing labor costs.

Their strength eliminates loss by breakage.

Their long life spells minimum per annum cost.

The lines shown below are carried at a minimum per annum cost on Northern White Cedar Poles.





No. 1 shows Northern White Cedar Poles in lines of the Columbus Railway, Power & Light Co. at Columbus, Ohio.

No. 2 shows Northern White Cedar Poles in lines of the Empire Gas & Fuel Co. at Bartlesville, Oklahoma.

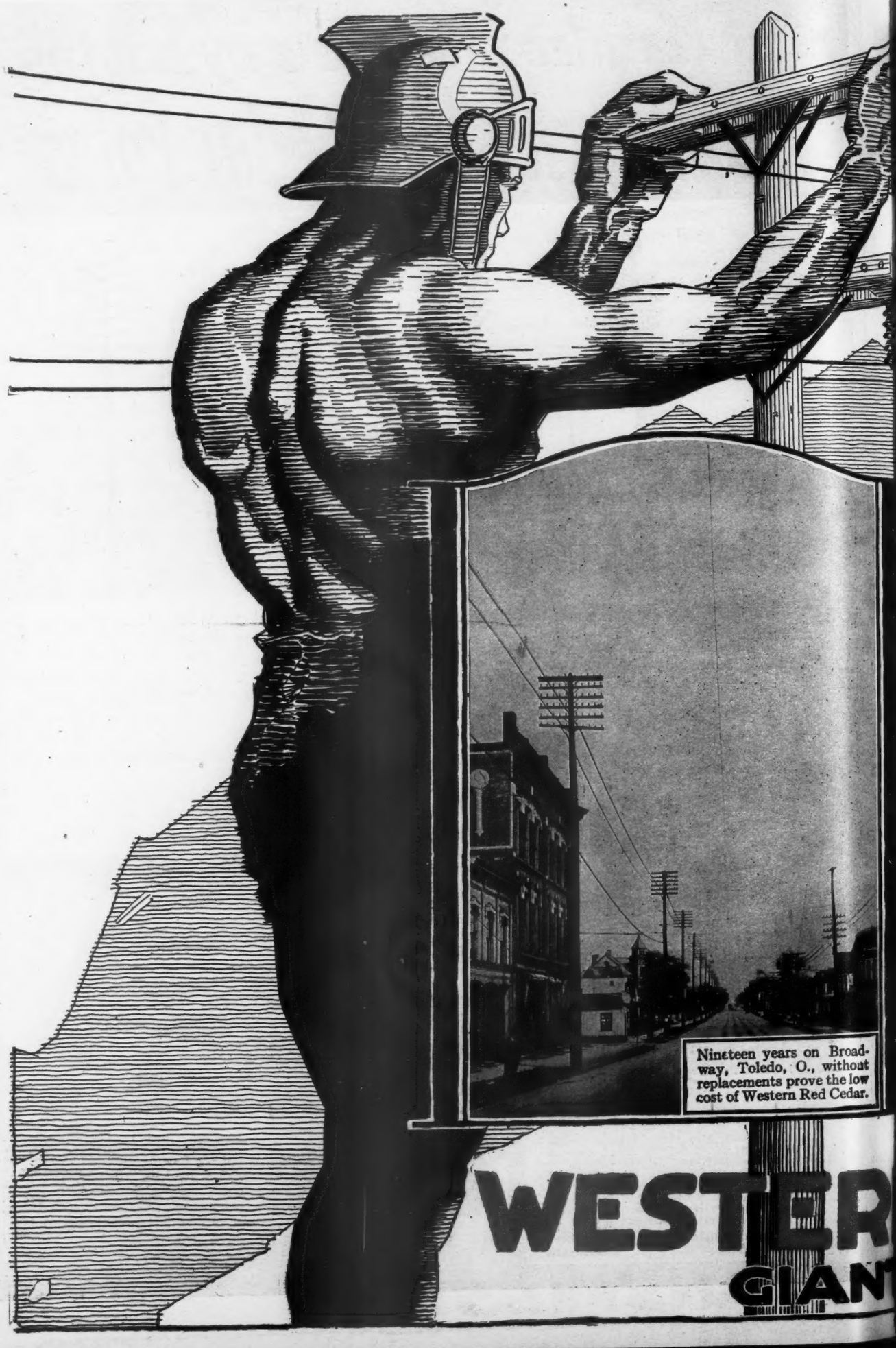
No. 3 gives a lead in the lines at Evansville, Indiana.

No. 4 shows a Northern White Cedar Pole line in Dallas, Texas.

For further data write

Northern White Cedar Association

Lumber Exchange Minneapolis



Nineteen years on Broadway, Toledo, O., without replacements prove the low cost of Western Red Cedar.

WESTERN
GIANT

Low Cost

WITHOUT a single replacement, without even being painted, and with a minimum maintenance cost, Western Red Cedar Poles have stood on Broadway, Toledo, Ohio, for over 19 years.

Under similar conditions these poles have stood for 18 years on Curtis Street in the same city.

For 21 years they have stood in the lines of the Wisconsin Telephone Company at Green Bay, Wisconsin.

The initial cost of these poles is nothing compared to the service rendered.

They carry the lines of the telephone company of Toledo with absolute safety. They create no adverse criticism against overhead construction because of their unsightliness. They interfere with no rights-of-way, and additional lines can be strung on them with no expensive additions save, perhaps a cross-arm. Butt-treatment in accordance with W. R. C. A. specifications, materially increases their life.

It is on this basis that the low cost of WESTERN RED CEDAR POLES has been established.

Do you know what the six vital pole requirements are?

Glance at the panel to the right.

Do the poles in the lines of your company meet all of these requirements?

Is your company anxious to establish a reputation for uninterrupted services?

Are you aware that this cannot be done unless poles of the character of WESTERN RED CEDAR are employed?

Send for our previous advertisements run in late issues of leading electrical magazines.

Learn how Western Red Cedar has proven itself to possess all of these vital requirements.

WESTERN RED CEDAR ASSOCIATION
PEYTON BUILDING
SPOKANE, WASHINGTON

RED CEDAR POLES
F TRANSMISSION

The Sign of Efficiency — The Sign of Durability

MORSE DRIVES

THE MORSE "ROCKER JOINT"

Positive as Gears — Flexible as a Belt

Longer Life

3 IN 1

THE 7½ H. P. constant speed motor with the 3-Speed Chain Drives pictured below, replaces a 15 H. P. motor with friction, variable-speed belt drive.

The Charm of Studying An Advertisement

picturing a successful achievement lies in the vision it brings of the possibilities of adaptation for overcoming deficiencies, improving quality, increasing production. The lowering of cost.

In these strenuous times early specifications of requirements are very desirable to insure prompt deliveries

MORSE CHAIN CO. Largest Manufacturers of silent chains in the world **ITHACA, N. Y.**

MORSE ENGINEERING SERVICE — ASSISTANCE WITHOUT OBLIGATION

Address Nearest Office

Baltimore, Md....1402 Lexington Bldg.
Boston, Mass.....141 Milk St.
Chicago, Ill.
Merchants Loan & Trust Bldg.
Detroit, Mich.....1003 Woodward Ave.
Charlotte, N. C.
404 Commercial Bank Bldg.
New York City
50 Church St., Hudson Term. Bldg.
Philadelphia, Pa....302 Harrison Bldg.
Pittsburgh, Pa.....Westinghouse Bldg.
San Francisco, Cal....Monadnock Bldg.
Atlanta, Ga.
Earl F. Scott, M. E., 702 Candler Bldg.
Canada.....Jones & Glassco, Reg'd
Montreal, St. Nicholas Bldg.
Toronto, Traders' Bank Bldg.
Kansas City, Mo.
Morse Engineering Co., Finance Bldg.
Minneapolis, Minn.
Strong-Scott Mfg. Co., 413 Third St.,
S. St. Louis, Mo.
Morse Engineering Co., Chemical Bldg.

"MORSE" is the Guarantee Always behind our Service, Efficiency and Durability

The advertising behind the

HUGHES ELECTRIC RANGE

This is only a suggestion of the methods we are using in helping the Central Station man put over the Hughes Electric. The advertisements reproduced here show the general type of Hughes advertising that is appearing this year in the Saturday Evening Post, the Ladies' Home Journal and Good Housekeeping.

If you are not getting your share of the business being developed by this advertising let us go over the Range situation with you. Write the Range Department at our Chicago office.

EDISON ELECTRIC APPLIANCE CO., Inc.

Chicago

New York **Ontario, Calif.** **Atlanta**

BENJAMIN PRODUCTS

Making Useful Things *More* Useful

In Industry

AMONG the many "Things More Useful," a small but important one is the Benjamin 903 Swivel Attachment Plug. Wherever there is an electrical appliance there is a place for one of these handy little plugs.

It Keeps Kinks out of Cords

—because it screws into the socket without twisting or turning the cord. An ingeniously devised shell which contains the screw threads swivels upon the plug proper and is held by a bushing from slipping up on the cord—thus the shell is the only part of the plug that turns and the plug itself goes into the socket as straight as a bayonet, never disturbing the cord or the appliance.

There are 903 Swivel Attachment Plugs for all purposes, from heavy asbestos heater cord and flexible armored cable to the smallest cord in use—plain or reinforced. All 903's fit Edison Screw Base Sockets or Receptacles.

Remember the standard, in our millions of homes, is the Edison medium screw base, whether in lamp sockets or wall receptacles. The Benjamin 903 Swivel Attachment Plug fits any Edison Screw Base Device. It is the least complicated, the easiest to use, and the logical Plug with which to equip an electrical appliance.

For information, write the Advertising Department
806 W. Washington Blvd., Chicago

BENJAMIN ELECTRIC MFG. CO.

Factories: Chicago and Desplaines, Ill.

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No. 903 Swivel Attachment Plug

In The Home

BENJAMIN

Makers of Things More Useful

The Macey Company, Grand Rapids, Mich.

An Unusual Photograph of an ABolite Installation

The above is truly a remarkable photograph of a lighting installation. It is unretouched and shows clearly the uniform distribution of light possible with the use of ABolite Reflectors.

Notice the absence of sharp shadows, the absence of contrasty high lights and shadows on the working plane, and the general pleasing appearance of the room.

Let Adams-Bagnall engineers plan a lighting layout for your plant.

Write for Catalog No. 175

ADAMS-BAGNALL ELECTRIC CO.
CLEVELAND
Chicago - - - 29 E. Madison Street

ABolite Reflectors

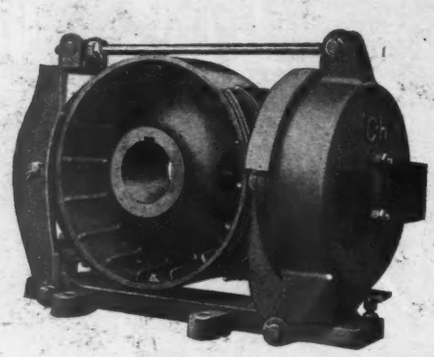
Four types of reflectors; RLM, Shallow Dome, Deep Bowl and Angle Bowl—furnished interchangeable with three types of holders and three additional types of one-piece neck construction—for Industrial Plants, Sign Illumination, Show Windows, Roadways, Sidewalks, Yardways, Garages, etc.

Small Motors—Gyro Fans.

ADAMS-BAGNALL

C-H

Where Are *You* Using C-H Type M Brakes?

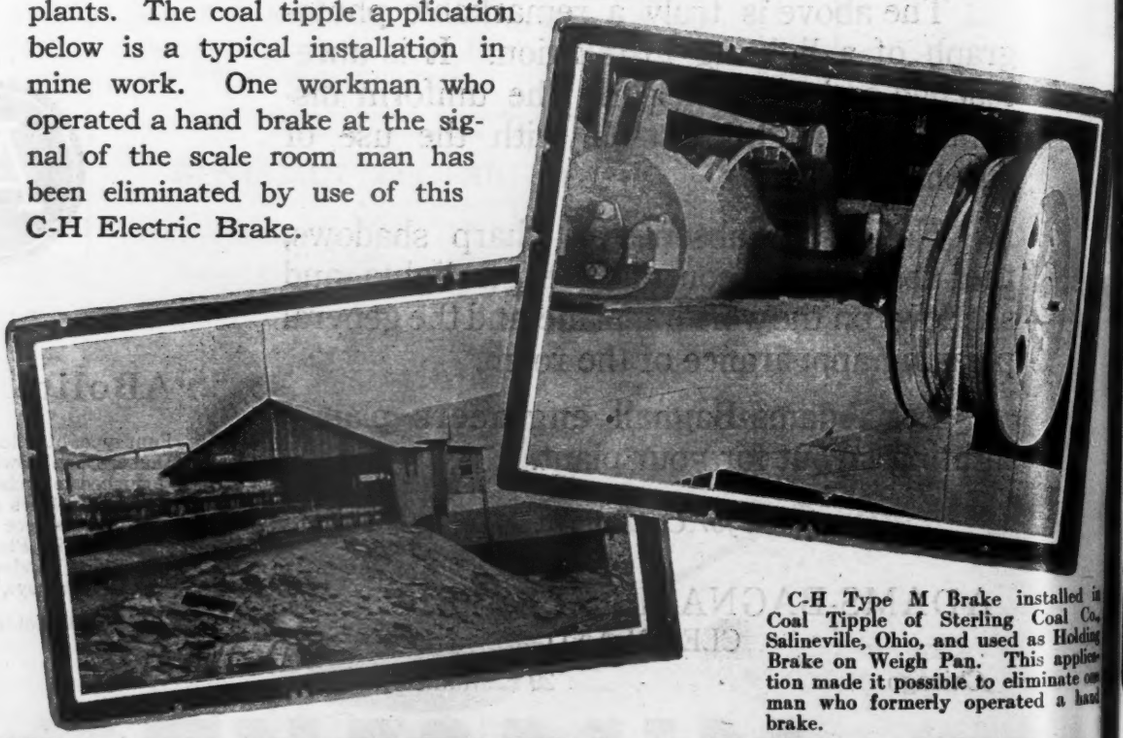


The Latest Design of C-H Type M Brake

Hundreds are being used in all kinds of hoists, cranes, and elevators —in mines, steel mills, and other industrial plants.

The small amount of space required, and the ease of adjustment make them the choice as standard in hundreds of plants. The coal tipple application below is a typical installation in mine work. One workman who operated a hand brake at the signal of the scale room man has been eliminated by use of this C-H Electric Brake.

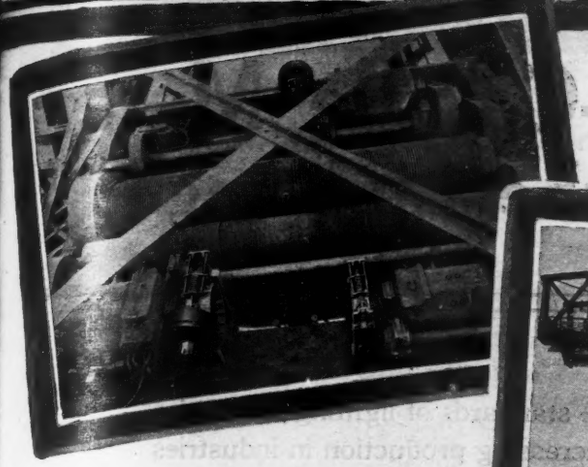
The overall height is only a trifle over the brake wheel since the latest design has the magnet armature built as an integral part of the arms carrying the brake shoes. Capacities from 1 to 300 H. P. are made in sizes from 8-inch to 30-inch.



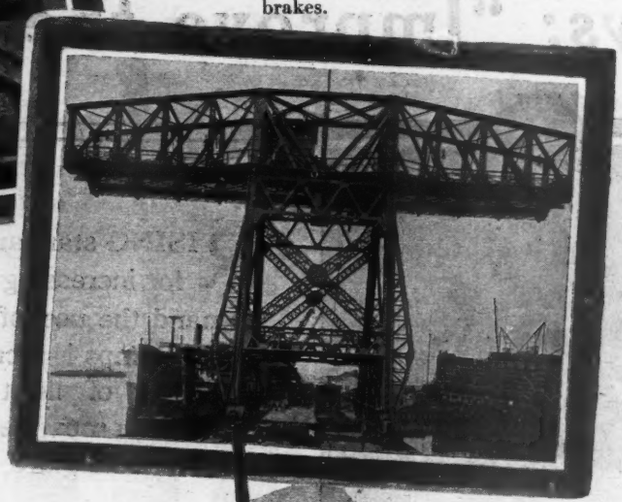
C-H Type M Brake installed in Coal Tipple of Sterling Coal Co., Salineville, Ohio, and used as Holding Brake on Weigh Pan. This application made it possible to eliminate one man who formerly operated a hand brake.

CUTLER-H

C-H



The boom motor is 35 H. P. with a 14-inch brake. The winding drum motor is equipped with a second brake, and the third is a modified type operated by a lever from the crane cab and is used with a 5 H. P. motor operating the "swing."



The 150,000 pound gantry crane at the Newark Shipyard has all its motors equipped with C-H type of brakes.

156 On One Boom Hoist Job

All the motors on the huge 75-ton gantry crane at the Newark Bay shipyard of the Submarine Boat Corporation, are equipped with C-H Type M Brakes. On every one of the 56 Boom hoists on the 28 shipways of this yard there are three C-H Brakes of this type.

New Booklet

Publication 850, giving complete description, illustrations, methods of application and other data, is ready for distribution. Any district office will send you a copy.

THE CUTLER-HAMMER MFG. CO.
WORKS: MILWAUKEE AND NEW YORK

District Offices: New York: Hudson Terminal Bldg. (50 Church St.); Chicago: 323 No. Michigan Ave.; Pittsburgh: Farmers' Bank Bldg.; Boston: 77 Franklin St.; Philadelphia: Commonwealth Bldg.; Cleveland: Guardian Bldg.; Cincinnati: Gwynne Bldg.; Detroit: 905 Kresge Bldg.

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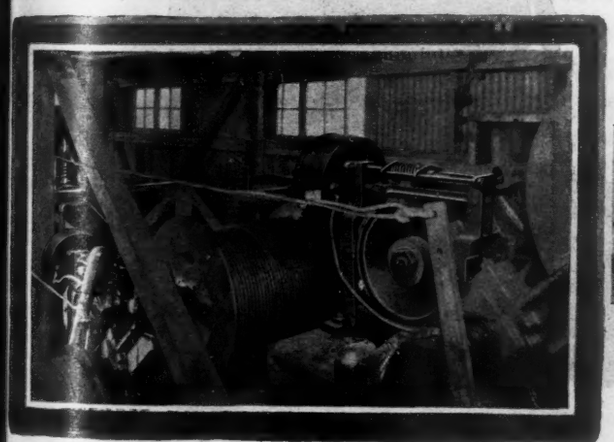
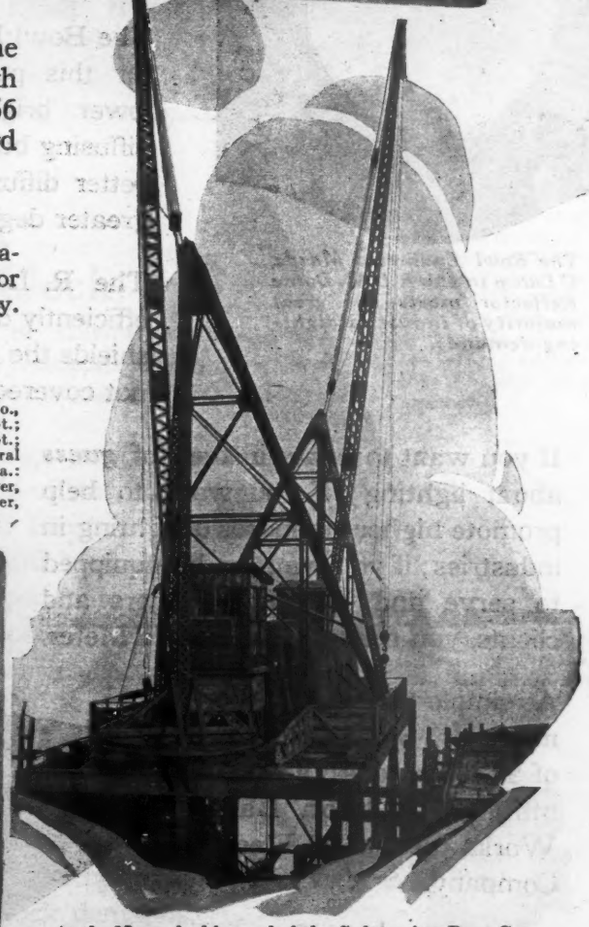
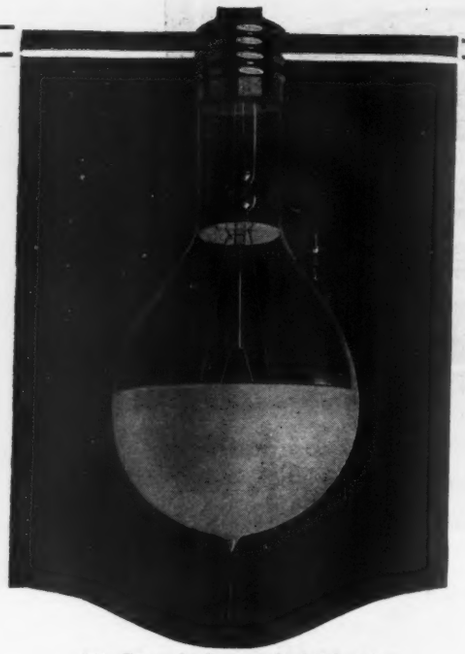




At the Newark shipyard of the Submarine Boat Corporation all of the 56 Boom Hoists on the 28 shipways are equipped with C-H Brakes—168 in all. These are used with the boom, winding drum and swing motors.

HAMMER

Rx When the Foot-Candle Meter *says:* "Improve the Lighting—!"



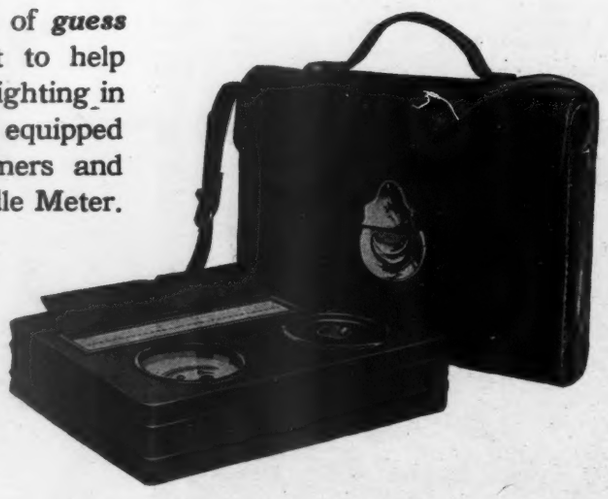
The Bowl Enameled Mazda C Lamp in the R.L.M. Dome Reflector meets the great majority of industrial lighting demands.

RISING standards of lighting intensities for increasing production in industries demand the use of larger lamps. As the size of lamps is increased there is a greater brilliancy of light source and additional precaution must be taken to insure diffusion and to avoid glare.

The Bowl Enameled Lamp was developed for this purpose. It has a considerably lower brightness than other forms of diffusing bulb lamps and therefore gives far better diffusion and can be viewed with a greater degree of comfort.

The R. L. M. Standard Dome Reflector efficiently directs the light on the work and shields the eye from that part of the lamp not covered by the diffusive coating.

If you want to ***know*** instead of ***guess*** about lighting; if you want to help promote higher standards of lighting in industries; if you want to be equipped to serve and advise customers and clients, you need a Foot-Candle Meter.



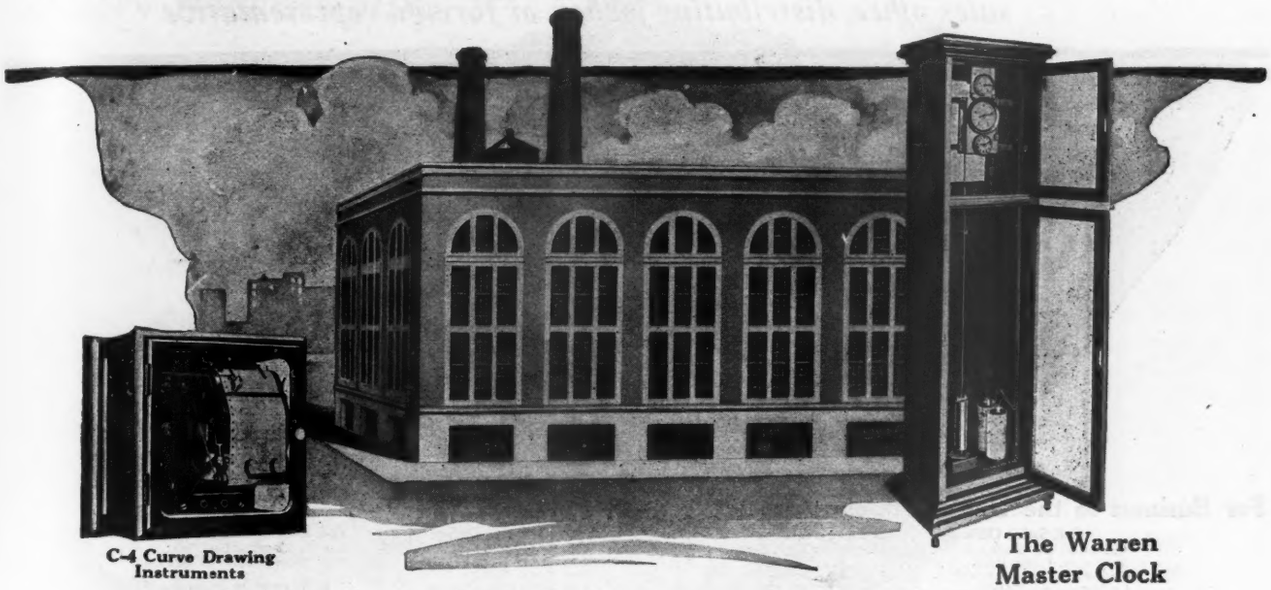
As simple to use as a thermometer. Sold at cost price of $25.00 through any sales office of Edison Lamp Works of General Electric Company.

S-17

EDISON MAZDA

EDISON LAMP WORKS OF GENERAL ELECTRIC COMPANY

Your alternators if run at a constant average speed can perform the function of a timekeeping device.



C-4 Curve Drawing Instruments

The Warren Master Clock

This device comprises a high-grade pendulum clock and a miniature self-starting synchronous motor. Each operates, independently, a hand on the dial of the master-clock. When the frequency is correct, both hands move at the same rate. The operator simply adjusts speed so that the hands will always be together.

G-2 and GS-2 Demand Meters

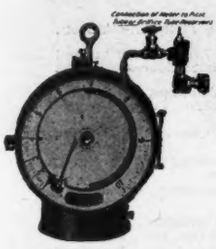
A Warren Master Clock

in your generating station enables the operator to easily maintain the generator speed at a constant average value

After establishing uniform average speed with the aid of this clock you can then use General Electric Graphic Instruments, Demand Meters, Flow Meters, etc., equipped with the Warren Synchronous Motor, instead of the familiar spring-driven clock, and from such instruments —

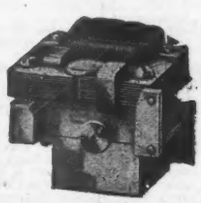
—obtain better time keeping qualities,
—eliminate winding,
—obtain synchronized records,
—obviate much of the attention a spring-driven clock demands.

PS-2 Demand Meter



Flow Meter

Drop our nearest office a line if you are interested and you will be sent descriptive bulletin.



Warren Synchronous Motor (¼ Size)

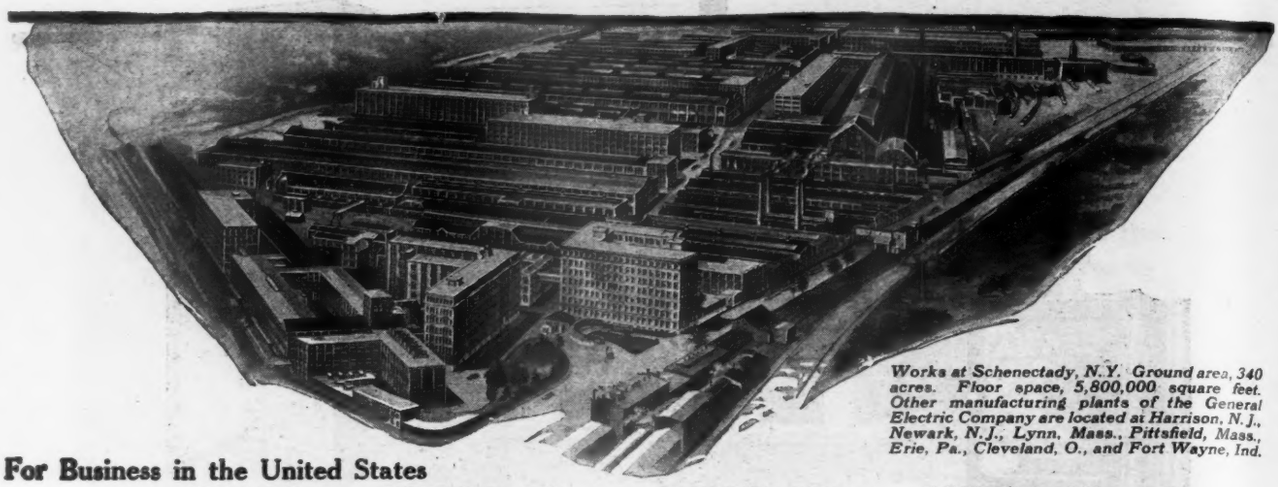
General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

Where to Get G-E Service—

Quick service is best obtained from the nearest G-E sales office, distributing jobber, or foreign representative



Works at Schenectady, N.Y. Ground area, 340 acres. Floor space, 5,800,000 square feet. Other manufacturing plants of the General Electric Company are located at Harrison, N.J., Newark, N.J., Lynn, Mass., Pittsfield, Mass., Erie, Pa., Cleveland, O., and Fort Wayne, Ind.

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Arkansas, Little Rock	
California, Los Angeles†	Pacific States Electric Co.
California, Oakland‡	Pacific States Electric Co.
California, San Francisco§†	Pacific States Electric Co.
Colorado, Denver†	The Hendrie & Bolthoff Mfg. & Sup. Co.
Connecticut, Hartford	
Connecticut, New Haven	
Connecticut, Waterbury†	New England Eng. Co.
District of Columbia, Washington	National Elec'l Supply Co.
Florida, Jacksonville	Florida Elec. Supply Co.
Florida, Tampa‡	Florida Elec. Supply Co.
Georgia, Atlanta§†	Carter Electric Company
Georgia, Savannah‡	Carter Electric Company
Illinois, Chicago§†	Central Electric Company Commonwealth Edison Co.
Indiana, Fort Wayne	
Indiana, Indianapolis	Indianapolis Elec. Supply Co.
Indiana, South Bend‡	South Bend Electric Co.
Iowa, Des Moines	Mid-West Electric Co.
Kentucky, Louisville	Belknap Hardware & Manufacturing Co., Inc.
Louisiana, New Orleans	Gulf States Electric Co., Inc.
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Massachusetts, Boston†	Pettingell-Andrews Co.
Massachusetts, Springfield	
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Minnesota, Duluth	Northwestern Electric Equipment Company
Minnesota, Minneapolis†	Peerless Electric Co.
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New York, Niagara Falls	
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New York, Schenectady	
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North Carolina, Charlotte	
Ohio, Cincinnati†	The F. D. Lawrence Elec. Co.
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Ohio, Youngstown	
Oklahoma, Oklahoma City†	Southwest G-E Co.
Oregon, Portland†	Pacific States Electric Co.
Pennsylvania, Erie	
Pennsylvania, Philadelphia§†	Philadelphia Electric Company Supply Department
Pennsylvania, Pittsburgh†	Union Electric Company
Rhode Island, Providence	
South Carolina, Columbia‡	Perry-Mann Elec. Co., Inc.
Tennessee, Chattanooga	James Supply Company
Tennessee, Knoxville	
Tennessee, Memphis	Electric Supply Company
Tennessee, Nashville	
Texas, Dallas†	Southwest G-E Co.
Texas, El Paso†	Southwest G-E Co.
Texas, Houston†	Southwest G-E Co.
Utah, Salt Lake City†	Capital Electric Company
Virginia, Richmond	Southern Electric Company
Washington, Seattle†	Pacific States Electric Co.
Washington, Spokane	
Washington, Tacoma	
West Virginia, Charleston	
Wisconsin, Milwaukee	

For Hawaiian business address Catton, Neill & Company, Ltd., Honolulu.

‡No G-E Office †Warehouse. §Service Shop.

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120 Broadway, New York, N. Y. 83 Cannon Street, London Schenectady, N. Y.

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General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities.

95-254

The safety and economies effected by electric heating have permeated almost every stratum of industry, easing workers' and owners' burdens alike

No factory fires can start from this soldering iron

SCORCHED work benches all over the land testify eloquently to the dangers of old-fashioned soldering irons carelessly laid down. Also it is well known that many a fire loss has been due to flare-backs by gas or charcoal bench furnaces.

G-E Electric Soldering Irons leave no excuse for such risks. They carry their "furnaces" securely in their tips and these hot points can never be laid against a bench for they are held clear by a guard ring.

The copper heads are calorized to lessen oxidation. The removable cartridge type of heat unit insures quick, steady heat. The iron's flexible handle permits accurate soldering in awkward corners.

For light or intermittent work with wax, solder, or even with lead these electric irons are always safe, reliable and easy to handle.

Have you ever tried one?

General Electric Company

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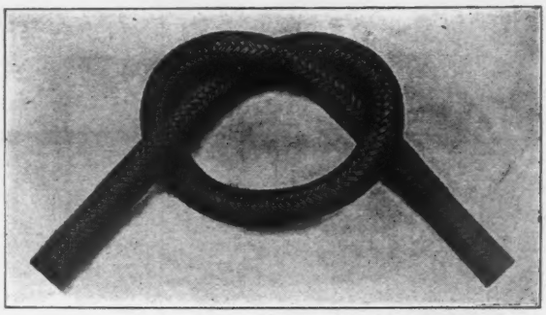
89-46

SIMPLEX HARD SERVICE CABLE

FOR PORTABLE TOOLS AND LIGHTS



Flexible as a lamp cord. Protected by a seine twine braid specially treated to withstand rough use. Recommended for portable tools and lights in machine shops, garages, shipyards and on any engineering or construction work where conditions are severe and continuous service is essential.

Send for descriptive circular No. 5.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
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Model 341 Portable A. C. and D. C. Voltmeter

Weston **Electrical Indicating Instruments**

are unqualifiedly superior to any other instruments designed for the same service. A. C. or D. C. Switchboard or Portable Instruments for every field of Indicating Electrical Measurement.

In writing for catalogs or bulletins please specify the field that interests you.

WESTON ELECTRICAL INSTRUMENT CO.
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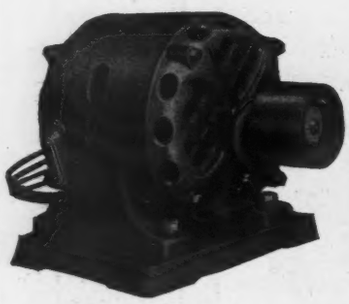
Century

Repulsion Start Induction

SINGLE PHASE MOTORS



Ratings
1/10 to 40 Horse Power

have efficient starting and operating characteristics. The low starting current and high power factor impose less demand upon transformers and transmission line. Starting current 275% of full load current.

A 125% fuse is sufficient.

CENTURY ELECTRIC COMPANY
St. Louis, Mo.
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INDIANA RUBBER AND INSULATED WIRE CO.

Paranite Rubber Covered Wires and Cables

IF IT'S **PARANITE** IT'S RIGHT

More Than Code Requires

Underground, Aerial, Submarine and Inside use

Telephone, Telegraph and Fire Alarm Cables, Lamp Cords, Portable Cords and Ignition Cables

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Electrical Review

Vol. 76—No. 26. CHICAGO, SATURDAY, JUNE 26, 1920. Page 1051.

Demonstration of Appliances Aids Merchandising

Public Is Shown Processes in Manufacture of Electric Flatiron With Beneficial Results in Educational and Sales Campaign of Electrical Appliance Manufacturer—New Service Station Opened

Upon the theory that grown people, as well as children, like to "see the wheels go round," many housewives throughout the country may have the privilege of being shown what is inside of an electric flatiron and how that particular brand of flatiron is manufactured. In a recent trial of the idea in Chicago it was demonstrated that the plan is not only effective as a sales proposition, but it is a step forward in teaching women to be unafraid of electricity as applied to the use of household conveniences.

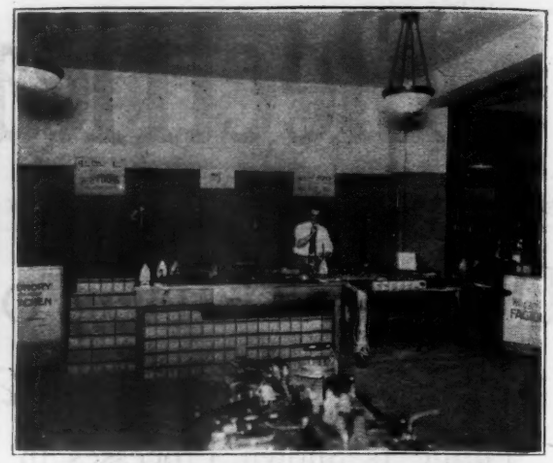
Recently the Edison Electric Appliance Co., which manufactures among other electrical goods a number of appliances under the trade name of "Hotpoint," established a team of demonstrators at the centrally located appliance store of the Commonwealth Edison Co., in Chicago. In one of the display windows was seated a young lady who busied herself making cords for the electric flatiron while she called the attention of those passing to some cards. The cards extended in various forms an invitation to enter the store and see how the flatiron is made.

Settings of the stage for the demonstration at the flatiron booth near the center of the big appliance store were such as to attract more than passing attention. A large sign announced that it was "From Foundry to Kitchen." As more than the usual number of people began to center around the booth they could be seen by others in every part of the store and the group soon swelled to a crowd that extended as far back as people were able to read the announcement cards and watch the manipulations of the demonstrators engaged in assembling the flatirons.

Distributed on the demonstrating counter were flatirons and parts of flatirons in various stages

Window Demonstration of "Hotpoint" Flatirons, Showing Each Process of Manufacture From Pigiron to Finished Appliance.

Some Steps in Manufacture of Flatirons as Demonstrated by Edison Electric Appliance Co.



"From Foundry to Kitchen" Is Style of This Assembling Display of "Hotpoint" Flatirons.

of construction, from the rude and heavy ingot of pigiron to the handsomely finished appliance with the cord attached and ready for use. The process of converting the pigiron into fine steel was briefly explained. Next, the fashioning of the parts from the steel were illustrated. It was shown that 16 operations were required to form the sole-plate, that part of the flatiron which gives the smooth finish to ironed clothes. So many operations were required to form the pressure and top-plate and so many more operations for each of the other parts, all of which were thoroughly explained as the demonstrator proceeded through the process of assembling.

Greater interest appeared to center about the display and sales talk regarding the resistance element, that piece of fabrication with which the heat is generated by the introduction of electricity. The handling of that part—harmless to the touch as it was displayed by the demonstrator and passed from hand to hand in the crowd—did more to win friends to the electric flatiron than any other single feature of the demonstration. It convinced many skeptical women who visited the display that there was no great terror concealed in the modern electric flatiron, and particularly in the one whose trade name was linked with that demonstration.

Proceeding with the demonstration the assemblers placed the resistance element between the pressure and sole-plate, clamped the top-plate into place, attached the heel-plate and terminal for the cord socket, made the proper connection for the electric circuit, fitted the handle and then passed the finished flatiron around for inspection.

Success of Such Demonstrations Assured.

During the process of demonstration the question of present high prices of electric flatirons was successfully met by giving a few cost figures in connection with the various processes and operations of manufacture. Coupled to the production figures were the points of simplicity of

General View of Interior of Edison Service Station in Chicago.

Interior View Showing Rear Portion of Edison Service Station.

Alcove, With Visitors' Writing Desk, Edison Service Station.

makeup and value to the user in long life and service, as well as ease of handling and attractive appearance. That this trend of the sales talk was effective was manifest in the large number of sales made during the daily periods of the demonstration. The campaign was scheduled to run one week, but the interest and results of the sales caused the management to extend the time another week.

The staging of the flatiron demonstration at the store of the Commonwealth Edison Co. was by way of a trial of this unique plan. The officials of the Edison Electric Appliance Co. are satisfied with the success of the trial and believe that it would be successful in the larger electrical appliance stores in other cities. It is contemplated to send out a number of demonstarting teams throughout the country if for no other reason than that such an exhibition, showing the inner parts or workings of one electric appliance and the safety of electricity in connection with household conveniences, would do much toward overcoming the timidity of many women in that regard.

As to the marketing of electric flatirons, the present demand for them is such that manufacturers report their inability to even approximately produce sufficient numbers. The cost of labor and material also continue to increase with a consequent greater burden upon the manufacturers.

Service Station for Service Only.

Coincident with the launching of its unusual method of popularizing the electric flatiron, the Edison Electric Appliance Co. has opened in Chicago a modern station to be devoted to service only. This station, which is one of a chain of service stations established in the larger cities of the United States, is for the accommodation of Edison dealers and users of Edison appliances, and will not be used for direct sales purposes.

One of the features of the Chicago service sta-

Front View of New Service Station of Edison Electric Appliance Co. in Chicago.

tion lies in the arrangement of its floor and window displays. This arrangement marks an effort on the part of the company to be of real assistance to its dealers in suggestions for floor plans and window displays. The station is arranged as a model retail dealer's store might be arranged in a room of similar proportions.

The windows are dressed tastefully, showing a typical display of appliances and fixtures. Color, motion and coolness are suggested to the visitor by an electric fountain a short distance within the entrance. A little beyond the fountain, extending along the middle of the room, is a large library table upon which are catalogs and magazines. Several easy chairs are provided about the table for visitors. Along the walls on both sides are distributed samples of the larger appliances, the smaller appliances being displayed in a large glass case along one of the walls where they may be observed from the library table.

At the rear of the store are the floor lamps and office fixtures and appliances, with the manager's desk against the rear wall. At one side, in the rear, is an alcove formed by screens and containing a writing desk, with stationery for the convenience of visitors. A door in the rear partition leads to the receiving and shipping room and to the basement stairway. The entire basement is devoted to the repair shop, which is competely equipped for prompt service.

Repairs While You Wait.

When a user of an Edison appliance or when a dealer comes into the service station with a a small appliance for repair he is invited to sit at the library table and read until the article can be examined and the necessary amount of repair determined. If it is a short job the visitor is invited to wait and take the appliance home with him. If the job will require more time the visitor is informed that the appliance will be returned to him by special delivery or parcel post. This plan obtains whether the customer comes from outside the city or resides there. While the customer is waiting one of the attendants or the manager engages him in conversation and endeavors to learn as much as possible regarding the customer's use of and experience with electric appliances, offering information and suggestions where it is possible to extend the service.

Dealers in the city or from the outside, who come into the station for repairs or information, find a warm welcome and an invitation to make the place their headquarters. There the dealer can attend to immediate correspondence or meet friends or business men by appointment.

Wherever the appliances of the company are marketed it is the policy of the service station staff to keep in correspondence with the dealers and users and encourage them to report the least inconvenience or trouble in connection with the use of electric appliances. This policy is intended to prevent as far as possible any dissatisfaction or misunderstanding that might result in an appliance being laid aside for some trivial cause, and a possible loss of confidence in that and other appliances by the customer.

RADIO ENGINEERS HEAR TALK ON WAVE BALANCE.

At the June meeting of the Institute of Radio Engineers, held at the Engineering Societies building, New York City, June 10, Prof. Michael I. Pupin of Columbia University, presented a paper on "The Wave Balance and Some of Its Applications." The paper dealt with the study of electric waves produced in antenna systems and described a new method of measuring the wave conditions at different points.

SOUTHERN CALIFORNIA EDISON CO. SELLS PASADENA PLANT.

After negotiations lasting since April, 1918, the city of Pasadena, Cal., has purchased the electrical distribution system of the Southern California Edison Co. in that city, the transfer having been authorized by the California Railroad Commission on June 10. The price paid by the city to the company was $533,262.33. The city has bonded itself for the purchase price and will take over the system as soon as the sale agreement is signed.

New Houses in Which Adequate Outlets Are Prominent for Their Absence

These houses are part of the first unit of a total of 1500 workingmen's homes being built by the Chicago Housing Association. Each home will be lighted with electricity. But the wiring plans are extremely simple, only one outlet being provided for each room. Outlets for electrical conveniences will undoubtedly be demanded in many of these homes in the future, and could be installed cheaper and easier while the houses are being built than at any other time. The wiring contractor did his best to have additional outlets specified, but his suggestions were probably overruled on account of the builder's efforts to keep the cost at a minimum. That it is false economy is evident to those who know conditions, but builders will have to be educated by the electrical industry, and especially the contractors, to that fact.

Making an Electrical Salesroom Attractive to Trade

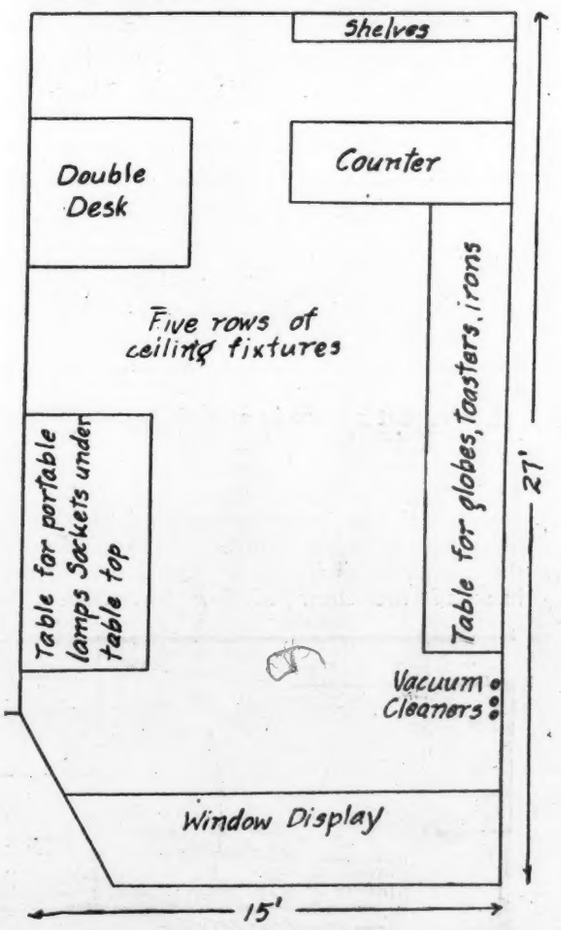
Experience and Observation Convince the Dealer That Customers Go Where Goods Are Arranged and Demonstrated Under Systematic and Convenient Conditions—Some Suggested Floor Arrangements

Laying out of the floor plan for an electrical appliance store depends of necessity upon the shape and dimensions of the room, the situation of the street entrance and other apparently minor factors. Electrical dealers have learned by observation and experience that the better and more remunerative trade comes to those stores where demonstrations may be seen and selection of fixtures and appliances made with the least discomfort and inconvenience. Taste and system in arrangement and display of the various kinds of goods quickly appeals to the customer and invites his return.

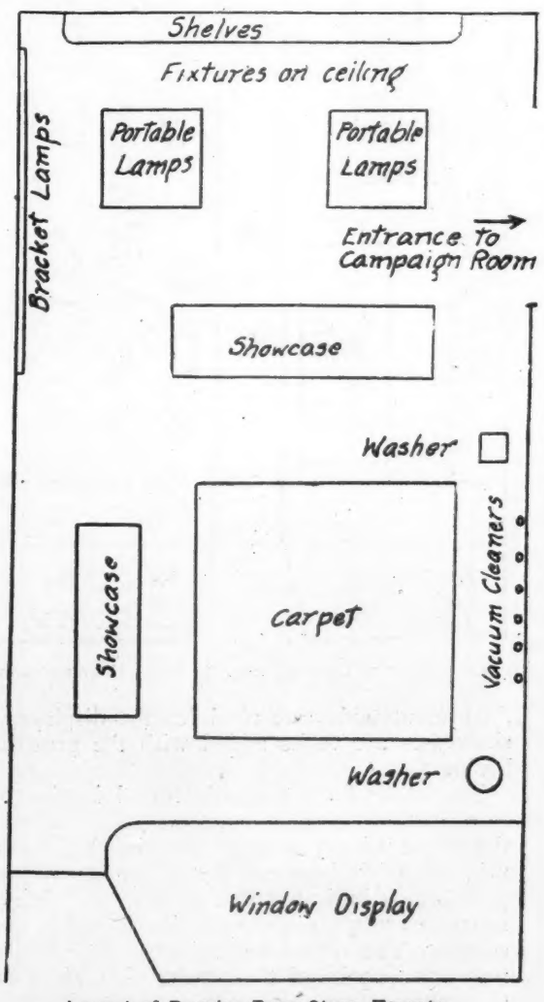
One of the floor plans illustrated herewith is that of the Calumet Electric Shop, located in a suburb of Chicago, which store was described at length in the May 29 issue of ELECTRICAL REVIEW. This store has a central street entrance with deep show windows on either side. The arrangement is such that the customer, the moment he enters the door, can very readily locate the desired department with a sweep of the eye.

One of the features of the Calumet Electric Shop is the case of shadow boxes for the display of lighting fixtures. If the customer is seeking such fixtures he can readily discern them in the big case along the wall at his left as he enters the store. If he is seeking the small appliances and portable lamps he discovers them immediately, almost in front of him to the left of the aisle. They are located on the large, plug-studded demonstrating table. Just beyond the table he can plainly see the floor lamps. Directly in front of the customer near the rear of the room is the accessory case, and to the left and rear of the case are shelves containing other fixtures, small appliances and package goods.

If the customer is in quest of a vacuum cleaner, washer, sewing machine, electric range or other large household appliance he notes how



Floor Plan That Greatly Increased Business.



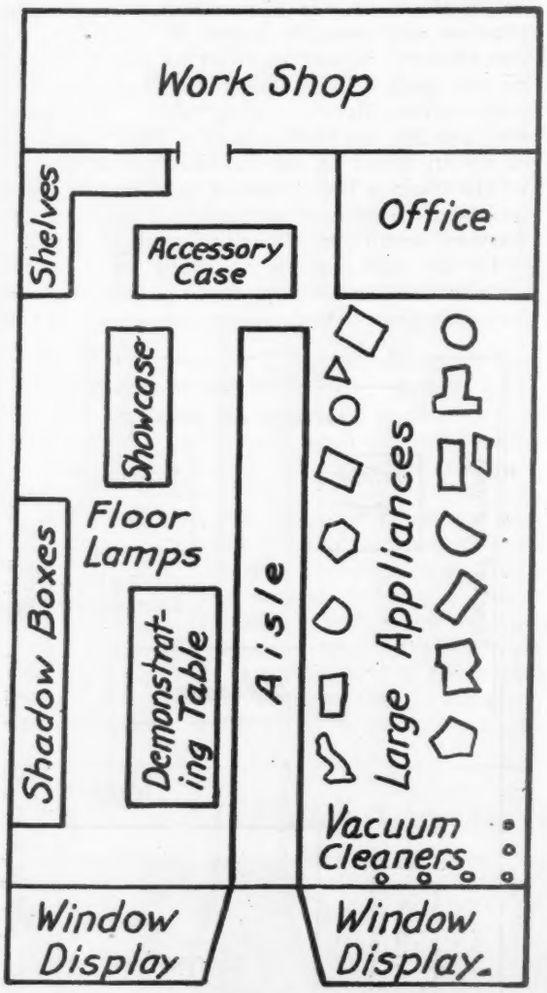
Layout of Douglas Bros. Store, Toronto.

tastily they are arranged in the large space to his right, with plenty of space about each machine for demonstration purposes. One wishing to reach the office finds it conveniently located on a slight elevation in the rear, at the right of the end of the aisle, and plainly discernible from the front of the store.

Floor Plans for Corner Entrances.

Another plan here illustrated is that of Douglas Bros., recently opened in Toronto, Ont. This layout of a store with a corner entrance is the result of keen observation on the part of the dealers of the shopping conditions and displays in other stores of various character.

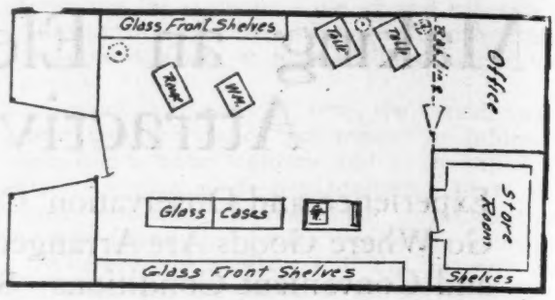
The Douglas store is 15 ft. wide and 27 ft. long, with a window display space 12 ft. long in front, 3 ft. deep and 13.5 ft. long at the back.



Floor Plan of Calumet Electric Shop, Near Chicago.

At present tables are used for the displays, but showcases are to be added with the growth of business.

The other floor plan illustrated is also of a store with a corner entrance. This layout is the result of careful consideration by the proprietor of his business for a number of years past, which indicated that he was not obtaining nearly as much business as he should properly expect. The recent rapid increase of his business has convinced this dealer that his conclusions were correct.

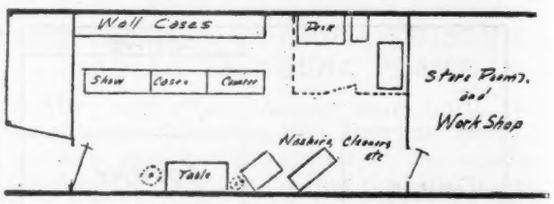


Typical Plan Designed for Central Entrance.

In addition to the three layouts of the dealers mentioned above, there is presented in three other illustrations typical floor plans designed by the Society for Electrical Development. These are considered only as suggested types, since all store rooms differ more or less from each other as to dimensions, location, daylight facilities and class of goods to be displayed.

Some Typical Floor Plans.

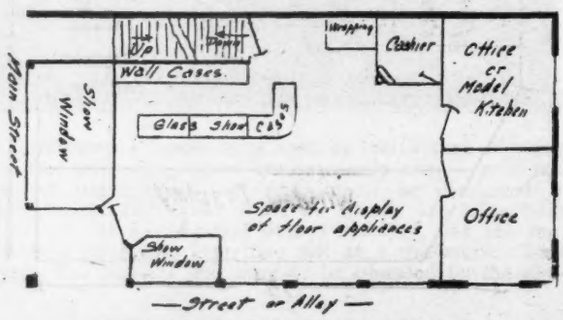
One of these typical designs shows a central street entrance flanked by two deep show windows of equal proportions. In this plan provision is made for glass-front wall cases for appliances, glass showcases for smaller devices convenient to the cashier's cage or cash register and wrapping counter. There are also two tables for showing portable lamps and table appliances. Floor space is provided for an electric range and one or two washers without



Floor Plan for Small, Narrow Room.

giving the store a congested appearance. In the rear is provided a small stock room, to be entirely inclosed, and an office space separated from the main store by a low railing that permits observation of the entire floor from the desk.

Laying out a store in a small, narrow room is suggested in the smaller illustration. In this plan the entrance is placed at one side to give a fairly large, unbroken space to the show window. A display and demonstrating table, backed by several large appliances, may be observed by the customer as he enters the door. Directly back of the show window a showcase and



Floor Plan for Large Corner Location.

counter are placed, with wall cases back of them. The office in the rear is railed off from the sales floor. Partitioned off from the store in the rear is the store room and work shop.

The suggested arrangement of a large store for a corner location is seen in another illustration. The main show window faces on the principal street, with a smaller show window near the front on the side street or alley, the street entrance being at the corner between the two windows. Access to the upper floors of the building is by means of a separate stairway, beneath which a stairway leads from the store to the basement storage and stock room, which may also contain the work shop. This store permits plently of daylight to enter and the arrangement permits a view of the entire store from the entrance. There is ample space on the floor for the display and demonstration of large appliances, and a table for small appliances may be conveniently placed, although none is shown in the illustration. Directly back of the front show window is a line of showcases, and wall cases mask in the wall inclosing the stairways. The cashier's cage is in the far corner, commanding a view of the entire store. It is also readily seen by a customer who must pass all the displays on his way to pay his bill.

CONSTRUCTION COMPANY MERGER IS CONSUMMATED.

New Company Issues Statement Telling How Dividends of Old and Present Concerns Are to Be Handled.

Official announcement of the consolidation of Westinghouse Church Kerr Co., Inc., and Dwight P. Robinson & Co., Inc., under the name of Dwight P. Robinson & Co., Inc., has been sent out from the new offices of the company, 125 East 46th street, New York City.

The new company is incorporated under the laws of Virginia and details regarding the dividends to be paid on the stocks of the old companies and the new concern were made public at the time of the official announcement of the consolidation.

The statement says that holders of certificates of deposit for both preferred and common stock of the Westinghouse company may present them at the Chase National Bank on and after June 15 and receive stock certificates to which they are entitled under the plan of merger. Holders of the preferred who make the exchange will receive dividends on that issue covering the period from January to May 1, of this year at the rate of 6% per annum while dividends on the first preferred shares of the new company will be cumulative from May 1, 1920, at 7%.

Holders of common stock certificates of the Westinghouse company who make the exchange will receive dividends at 5% a year for one month, dividends having been paid for three months at that rate on March 10, 1920.

Holders of the certificates of deposit for the two classes of Westinghouse stock, calling for cash, and holders of the preferred stock of the old Robinson company, upon duly surrendering the same, will receive cash at the rates provided in the agreement. Holders of the certificates for the common stock of the old Robinson company will get the shares of the certificates of the new company under the terms of the plan.

The officers of the company are Dwight P. Robinson, president; T. N. Gilmore, first vice-president; I. W. McConnell, R. M. Henderson and L. H. Bean, vice-presidents; A. K. Wood, vice-president and treasurer; H. H. Kerr, vice-president in charge of Chicago office, and W. L. Murray, secretary.

U. S. CIVIL SERVICE COMMISSION SEEKS ENGINEERS.

Will Hold Open Competitive Examination for $14 a Day Vacancy at Naval Ordnance Plant, South Charleston. W. Va.

The United States Civil Service Commission announces an open competitive examination for electrical engineer to fill a vacancy at the U. S. Navy ordnance plant at South Charleston, W. Va., the position paying $14 per diem. Vacancies in positions requiring similar qualifications, at this or higher or lower rates of pay, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

All citizens of the United States who meet the requirements, both men and women, may enter this examination; appointing officers, however, have the legal right to specify the sex desired in requesting certification of eligibles. For the present vacancy male eligibles are desired.

Competitors will not be required to report for examination at any place but will be rated on the following subjects, which will have the relative weights indicated on a scale of 100: (1) Physical abiltiy, 10. (2) Education, training, experience and fitness, 90.

Competitors will be rated upon the sworn statements in their applications and upon corroborative evidence.

The appointee will have charge of all electrical design and supervision of installation, operation, testing and maintenance of all electrical equipment of electric power plants and substations; drive for hydraulic and mechanical equipment, electric traveling cranes and locomotives, electric melting and electric treatment furnaces, and electric power and lighting systems.

Applicants must have at least 10 years of electrical engineering experience, of which at least four years must have been in plants manufacturing large steel forgings for ordnance (armor, guns and projectiles). The completion of each year of an apprenticeship course with a large electrical manufacturing company, and the completion of each year of an engineering course (preferably electrical) in a college or university of recognized standing, will be equivalent to one year of general experience. Applicants must not have reached their forty-fifth birthday on the date of the examination. Age limits do not apply to persons entitled to preference because of military or naval service. Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., prior to the hour of closing business on July 27, 1920.

Electrical Industry Celebrates in Los Angeles

Dealers, Manufacturers and High School Electrical Students Participate in the Industrial Week Observation—Some Unique Displays Arranged for the Event by Central-Station Companies

By W. B. STODDARD

One of the most interesting features of the big parade during the "Industrial Week" celebration in Los Angeles recently was that section devoted to the electrical industry. Of chief interest in this section was the series of floats entered by the high schools of Los Angeles and vicinity, showing the various arts and crafts taught in the schools.

One of the high-school floats referred to the use of electricity in the automobile industry. It contained several stout tables covered with electrical apparatus at which a number of embryo automobile mechanics and electricians, with sleeves rolled up, were busily working. Another school float, devoted to electric wiring, showed an installation of a double wall board fitted up with apparatus at which a number of boys worked.

One of the floats of local electrical dealers, that of the Lamp Shop featured a variety of electric lamps in an artistic manner. Mounted on this float was a small house containing six windows, in which were displayed lamps ranging from the large floor lamp to the tiny boudoir lamp with silken shade to match the upholstery of a room.

The United States Electrical Manufacturing Co. had a float on which was displayed some of the massive motors and other machinery manufactured by the concern. A card informed the public that the company also manufactured grinders, buffers, motors and generators. Among other local electrical concerns that had floats in the parade were the Electrical Products Co., Cain Gas Radiator Co., and the Plumb Tool Manufacturing Co.

Some Interesting Electrical Demonstrations.

The Bureau of Light and Power took advantage of the event to impress upon the public mind the desirability of having homes wired for electricity, using an effective window display to further the purpose. In the background of this display window was a three-panel oak screen upon the central panel of which was depicted a modernized colonial house. Three words of four letters each, and one word to a panel, ad-

High School Float of Auto Electrics in Industrial Parade in Los Angeles.

monished the observer to "Wire Your Home." Cards attached to the two outer panels contained the following messages:

COMPLETE ELECTRIC SERVICE

assures the ready use of all the electrical necessities, conveniences and distinctions which can be obtained today at so low a cost.

THE COMPLETELY WIRED HOME

provides the comfort, enjoyment and release from household drudgery which can be obtained only through the use of electrical appliances. Examine these devices and learn their use.

The space in front of the panelled screen was effectively dressed with electric percolators, toasters, waffle irons and an electric vacuum cleaner.

STREET CROWDS PUSH BUTTON AND OPERATE WINDOW DEMONSTRATION.

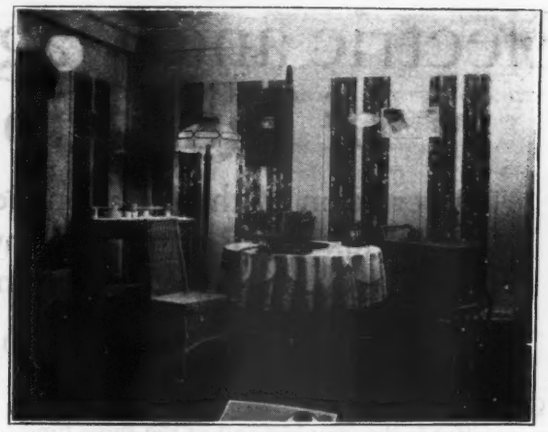
By permitting the throngs on the street to operate many electrical devices themselves the Southern California Electric Co. aroused much interest and enthusiasm in its window display of household conveniences. In the background of the window was hung a large flag and in front of it were suspended a number of electric fans. Set in standards were several other flags, while down in front were some small desk fans. In the center of the display, surrounded by household appliances, was a wireless outfit on a mound of blue velvet. An electric lamp was suspended over a placard in the center of the background.

On the outside of the window, attached to the surface of the glass, was a push-button. Pasted beneath the button was a card bearing the invitation to "Run all the electric appliances by wireless control. PUSH THE BUTTON." When the button was pushed by an observer the lamp would flash on, the sewing machine motor would run, the fans start to whirl and blow out the folds of the flags, and blue sparks would be emitted from the wireless outfit. Blue and white cards gave the name and price of each article on display.

DEMONSTRATES COOKING DEVICES AND FEEDS THE PUBLIC.

The Los Angeles Gas & Electric Co. featured the spirit of co-operation with other local industries in a large show window fitted up to represent a breakfast room. Foods and furnishings bore the names of their local manufacturers. During the afternoons of industrial week a lady demonstrator in white cap and apron presided at the table. She used electrical appliances to grill sausages, toast bread and make percolated coffee and sandwiches.

Float of One of the Los Angeles Electrical Dealers.



Demonstration Window of Los Angeles Gas & Electric Co. From Which Electrically Prepared Food Was Dispensed.

In the window was a card inviting the public to come in and try the electrically cooked food. Two young ladies in white uniforms served the guests. The entire arrangement proved excellent publicity not only for the electrical devices, but for the food products, thus winning the cooperation of outside interests. It brought great crowds into the store who, after being served with the cookery, took time to inspect the interior displays of washing machines, vacuum cleaners, sewing machines and many other household appliances, each of which was tagged with a neat price card.

Thus did industrial week, now an annual event in Los Angeles, give the electrical industry an opportunity to show the important part it is playing in the building up and modernizing of that important western city.

CENTRAL STATION INCREASES LOAD AND STATION CAPACITY.

The Penn Central Light & Power Co., Altoona, Pa., contemplates improvements costing approximately $900,000. The power plant at Williamsburg, Pa., will be doubled, the present structure being duplicated. The one building just completed is under roof and ready for the generators. The power increase will be from 11,000 to 22,000 kw. and the size of the substation at Collinsville, outside of Blair county is being doubled. The company is extending a duplicate line from Altoona to Williamsburg, a distance of 12 mi. New lines to furnish power to the Canoe Creek Stone Co. quarries and the Bennington mines are being constructed. A new substation is to be constructed at Spangler, with a power line extended to the Patton Clay Works, the Patton plant anticipating a load of 600 hp. The Sterling Coal Co., between Spangler and Bakerton, has decided to operate the mines by electricity and will use about 1200 hp. The firm has contracted for power for the C. A. Hughes mines at Lilly, and Lincoln Coal Co. mines at Nant-Y-Glo. The improvements also take in the plants at Huntingdon, Mt. Union and Lewiston.

Electric and Magnetic Operations of Induction Machines

Description of the Relation Between Electric Current, Magnetic Flux and Rotation or Power Developed in an Induction Motor—Comparison With the Operation of Transformers

By JACOB GINTZ

Comparison with the operation of a transformer affords the simplest and at the same time the best method of describing the operations that take place within the windings and cores of an induction motor. The main difference between the two pieces of equipment is the fact that the two separate parts of the windings of a motor are connected together by a set of bearings which allow one winding to move, thus giving up mechanical energy, while in the transformer, all parts being held in a fixed position, only electrical energy is given out. In a similar manner, the transformer may be used to illustrate the operation of both the a-c. generator and the synchronous motor.

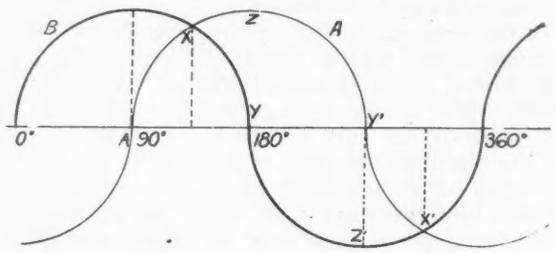


Fig. 1—Curves Representing Current in or Voltage on a Two-Phase Circuit.

The windings for the armature of an a-c. generator and for the field or stator of an induction motor are put in and connected up in the same manner. In fact, by changing rotors, a given stator may be used as either an induction motor or a generator. A synchronous motor is identical, in so far as the wiring diagrams are concerned, with an alternator or a-c. generator, and a synchronous converter is simply a synchronous motor with a commutator attached and suitable brush equipment provided like that found on an ordinary d-c. generator. Thus, it is seen that no new principles are involved in the winding of a-c. machines that are not involved in the winding of d-c. machines, which windings have already been fully discussed in former articles. The main point of difference lies in the fact that in induction motors and in most a-c. generators the armature windings are placed in the stationary core instead of in the rotating core.

A transformer, with which the motor and generator are to be compared, consists of two coils of wire wound around a common axis. For efficiency, it is customary to mount the two coils on a laminated-iron core in such a manner that the maximum amount of magnetic flux will be produced with a given expenditure of energy. One of the coils, for convenience, will be called the primary coil and the other will be called the secondary. When the terminals of the primary coil are connected to an a-c. circuit an alternating current is set up in the primary coil and, due to this current, an alternating magnetic flux is set up in the transformer core, around which both coils are wound. In other words, the magnetic flux is first entirely lacking, then appears and becomes larger, then decreases and becomes zero again and grows in the opposite direction. It is evident that such a variation in the magnetic flux within the transformer-core, around which the secondary coil is wound, results in the magnetic lines cutting across the secondary-coil loops, thus generating a voltage. The voltage generated will depend upon the winding of the coil, the magnitude of the flux and other minor details, and will have a frequency or number of cycles identical with the frequency of the magnetic flux which, in turn, has the same frequency as the circuit to which the primary coil is connected.

Relation Between Various Machines.

Voltage is produced in d-c. generators by the movement of the coils across the magnetic flux produced by the field windings. In an a-c. generator, it is customary to fix the position of the armature coils and to move the flux by rotating the field windings. If, instead of rotating the field coils of the a-c. generator, an alternating

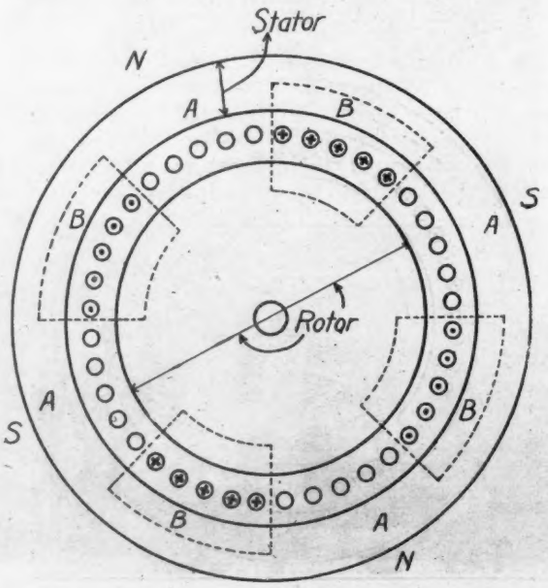


Fig. 2—Magnetic Poles Opposite A-Phase Coils.

current be supplied to the fields, the generator would become a transformer, and an alternating voltage would be set up in the armature windings. In case the armature windings were connected, so that a circuit was completed, an alternating current would flow and the generator would become a working transformer. However, there is a reaction between a wire or conductor carrying current and a magnetic field which tends to move the wire across the field. Such a reaction causes the rotation of an a-c. motor when the elements are properly arranged to set up the various relations in proper order.

In an induction motor arranged for two-phase operation, there are two separate windings on the armature and for three-phase operation there are three separate windings. These windings may be coupled together at their terminals, it being customary to connect the three-phase windings in a star or delta connection. In the two-phase winding the various groups of coils are spaced alternately around the armature, while in the three-phase windings every third coil or group of coils would be connected together to form the complete phase. By such an arrangement of two or three separate windings, each connected to different phases of a two or three-phase circuit, the rotating magnetic field of the induction motor is produced. In a four-pole, two-phase motor there would be eight groups of coils while in a four-pole, three-phase motor there would be 12 groups of coils.

Operation of the Two-Phase Motor.

Taking the two-phase motor, the voltage curves of the phases are shown in Fig. 1, curve *A* applying to *A* phase and curve *B* to *B* phase. Fig. 2 shows a diagrammatic outline of a two-phase, four-pole motor, with the armature coils shown in the space between stator and rotor cores, the armature slots being left out for the sake of simplicity. The cross mark in the coil circle represents a current flowing away, and a dot represents a current flowing towards the observer, the dotted circles representing the returning sections of the coils marked with the crossed circles. It will be noted that the coils are divided into two general groups marked *A* and *B*, each group or set of coils being connected to the corresponding phase of the two-phase circuit. It will also be noted that the group *A* is not designated as carrying current in any direction, this diagram indicating the instant at which the *B*-phase current is a maximum and *A*-phase current is zero. Corresponding to the current in the various conductors,

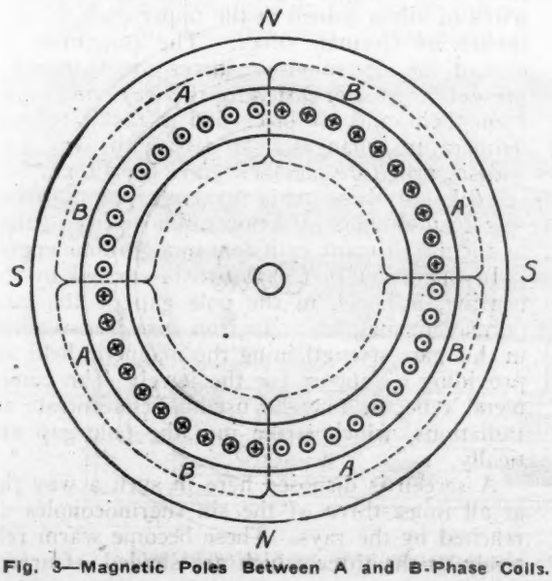


Fig. 3—Magnetic Poles Between A and B-Phase Coils.

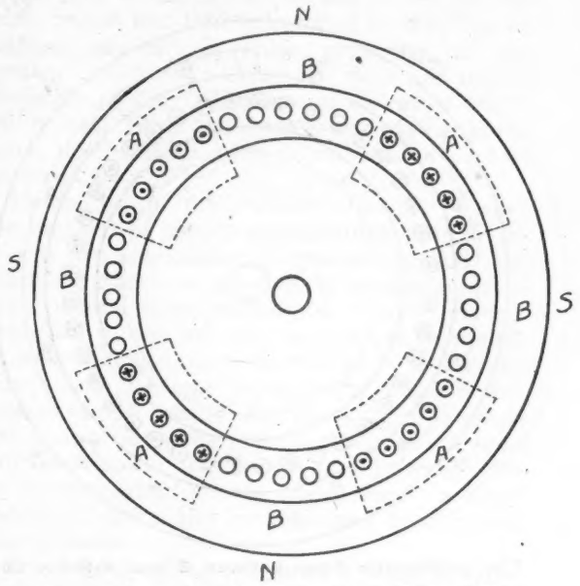


Fig. 4—Magnetic Poles Opposite B-Phase Coils.

four magnetic poles will be set up by the magnetic lines surrounding the coils, the poles assuming the positions marked *N* and *S*. Since the voltage and consequently the current and magnetic flux of each phase is continually varying according to a curve like that shown in Fig. 1, the conditions shown in Fig. 2 will change by having current appear in the coils of *A*-phase producing a condition like that shown in Fig. 3. As the current in *A* increases and that in *B* decreases, the magnetism produced by the two phases gradually changes in strength shifting the position of the poles, as may be noted by comparing the locations of the pole indications *N* and *S* in the two illustrations. The current changes continue in the phases until *B* current becomes zero and A current becomes a maximum, as indicated in Fig. 4. In another short interval of time current begins to appear again in *B*-phase producing the condition shown in Fig. 5.

By examining the four illustrations, it will be seen that the pole centers, marked *N* and *S*, have moved from opposite the center of the *A*-phase coils to a point midway between *A* and *B*, then to a point opposite the center of the *B*-phase coils, and finally to a position midway between *B* and *A*. The next movement would place the pole centers over the center of *A*-phase coils, bringing the conditions, so far as the magnetic poles are concerned, to the starting point. By repeating this process four times the entire magnetic field of the motor will be given a complete revolution, producing much the same effect as if the winding had been excited with direct-current and the machine turned or rolled over. Also the effect is much the same as that produced by the rotation of a rotor having defi-

nite pole pieces, the coils of which are excited with direct-current.

MOVEMENT OF THE INDUCTION-MOTOR ROTOR.

Giving consideration to the rotor, it will be seen that it is subjected to the action of a magnetic field in continuous rotation. Then as long as the rotor is at rest its windings will

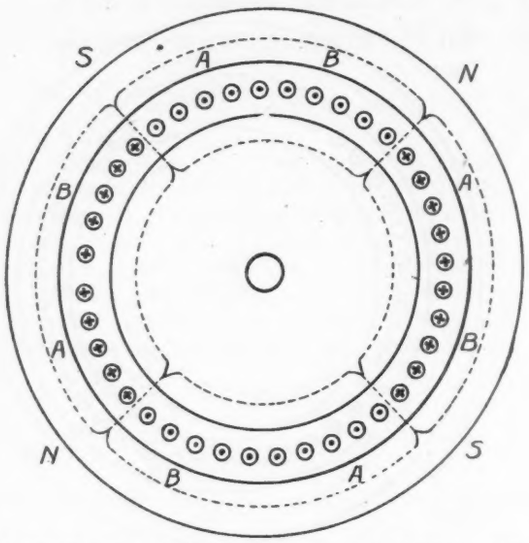


Fig. 5—Magnetic Poles Between B and A-Phase Coils.

be cut by the magnetic lines produced in the stator. Currents will flow in the rotor and, due to these currents, a force will be exerted tending to move the rotor windings. However, the rotor is movable and, if the motor is properly built, the rotor will revolve. The speed of the rotor will increase until it has nearly the same speed as the rotating magnetic field, which speed is called synchronous speed. It is evident that an induction motor cannot of itself ever attain synchronous speed because if it did there would then be no relative motion between the rotor and rotating magnetic field, the rotor conductors would not be cut by magnetic lines, the transformer action would stop, no current would be induced in the rotor, consequently no force would be exerted by the field on the rotor conductors and there would be no means of supplying energy to overcome friction and other resistance.

COAL-CONSERVATION FILM SHOWS VALUABLE INFORMATION.

Many Interesting Economic Problems Pertaining to Coal and to Boiler-Room Practice Are Presented in Picture Form.

Engineering clubs and societies, manufacturers' associations, commercial organizations, technical schools and the educational departments of large corporations will be interested in the recent announcement by the Diamond Power Specialty Co., Detroit, Mich., that it now has available for free distribution three copies of its motion picture, "Coal Is King." This picture was prepared from a scenario by Robert June, and the pictures were taken under his direction.

The film was originally prepared as part of the Coal Conservation Campaign carried on during the recent war, but has just been completely revised and brought up to date, all war material being eliminated and much new material added. The film deals with good and bad methods of coal mining and transportation, good and bad methods of firing, combustion losses and their minimization, power plant instruments such as draft gauges, CO_2 recorders and their uses, losses caused by leaky boiler settings, good and bad management of the boiler room, and the necessity for keeping the boiler surfaces clean. Pictures of scale and soot removal, losses caused by firing boilers too high or too low above or below rating, losses caused by cutting in standby boilers too early or too late, and losses caused by uncovered steam pipes, leaky pipes, steam traps, etc., are shown.

The film is in four reels, requiring approximately 50 minutes to be shown.

DERIVING ELECTRICAL POWER FROM SUNLIGHT.

By Thermoelectric Means Radiation From Sun or Other Source Is Utilized in Method Invented for Purpose of Developing Power.

The task of more directly getting hold of the radiant energy of the sun for the purposes of mechanical motion instead of pursuing it around through the indirect and labor-involving processes of organic growth, evaporation, combustion, or other of its secondary terrestrial effects, is both important and fascinating. The problem has always been a leading one in the interests of experimenters and it is clear that a complete solution would have profound effects.

An instrument has been invented, writes Paul Kirkpatrick in *Scientific American*, which develops its small amount of power immediately upon exposure to sunlight. It is a form of electric motor, yet is independent of batteries or any external current source, its minute currents being thermoelectric, resulting from the heating radiation which falls upon it. The currents arise within the armature and do not leave it.

Of the motor's separate parts, the drum armature, resembling a cage, is made up of vertical wires of silver joined at the upper ends to short spokes of German silver. The junctures, the seat of the electromotive forces, are flattened to present a greater area to the rays impinging upon them, and are blackened to facilitate quick temperature changes. Models with two, four and six armature members have been found successful, but those with the larger number possess a smoothness of action similar to that gained by the use of many cylinders in a gasoline engine.

In operation the armature is carried by one bearing, a jewel, in the pole gap of the large permanent magnets. An iron core is also placed in this gap, strengthening the magnetic field and providing a support for the jewel. The conical metal reflector may be used to concentrate the radiations, which strike into the pole gap vertically.

A screen is disposed here in such a way that at all times three of the six thermocouples are reached by the rays. These become warm relatively to the three which are shaded. Currents

result which, traversing the armature wires, react upon the magnetic field and cause rotation as in any electric motor. As rotation proceeds, each couple at a certain point crosses the boundary of shade and changes from hot to cold or vice versa, and so the currents preserve their proper directions at all times, the device of the screen serving for the brushes of an ordinary d-c. motor.

The motor will operate under the action of sunlight, an electric lamp or any other source of energetic radiation, visible or invisible. If the position of the shading screen is properly altered the direction of rotation is reversed. A particle of carbon dioxide snow of the size of a match head placed near the armature on the exposed side will also reverse the rotation. A convex lens of glass may be used to concentrate the radiations instead of the metal cone used, but being opaque to long waves, the glass absorbs much of the useful energy of the incident rays.

DEMONSTRATION OF VOCAL MAGNIFICATION AT CHICAGO.

Development of Loud-Speaking Telephone Which Shows Efficiency in Transmission of Speech to Distant Points of Convention Hall.

For the first time in many years, delegates and visitors at the Republican national convention were able to hear the voices of the chairman and other speakers no matter how far from the stage they happened to be seated. This seeming miracle was accomplished by the latest development of the loud-speaking telephone. Just in time for this convention, the engineers of the Bell Telephone System successfully completed the voice-magnifying apparatus, embodying newly discovered features of telephony which the inventor of the telephone could not have foreseen.

In the Coliseum's vast auditorium in Chicago, the experts of the American Telephone & Telegraph Co., the Western Electric Co. and the Chicago Telephone Co. worked for ten days installing the apparatus through which electricity served clear and distinct sound to the occupants of the more distant seats. There was little to be seen of the mechanism in the great convention hall. An inconspicuous transmitter of speech was raised a few feet from the front of the speaker's platform, and overhead were suspended several receivers, these being rectangular wooden horns about 10 ft. long, with their open ends pointed towards various parts of the auditorium, flags and bunting almost concealing them.

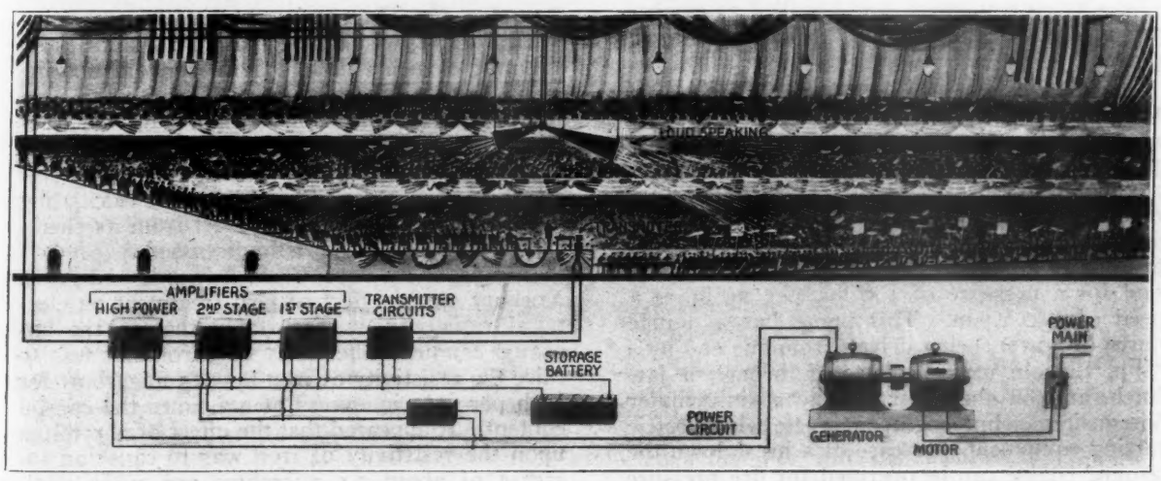
Without seeing how it was done the audience found that, as far as hearing was concerned, the great crowd had been telescoped by this "public address system" in close proximity to the speaker's platform. Under the floor and behind the walls of the Coliseum ran the wires which led to and from the speech-magnifying apparatus, itself hidden away in an isolated part of the building.

Unlike any of the previous attempts to solve the problem of speech magnification, this invention is not spectacular in appearance, and, like telephone plants in general, it accomplishes its great results from behind the scenes. Speech electrified in one way can be sent for thousands of miles along a wire; if electrified in another way it can be sent through the ether across continents and oceans; electrified in still another way it can be discharged from a receiver horn with such power that it will travel through the air as the natural sounds travel, but to a much greater distance and in a manner to dominate other sounds.

The loud-speaking telephone system installed in the Coliseum at Chicago and to be installed in the San Francisco convention hall has been in process of development for about ten years. The experiments have been numerous and of great scientific interest.

In the new loud-speaking telephone the force of the original wave-carrying current is magnified many thousands of times before it is delivered to the loud-speaking receiver and there converted into sound. The loud-speaking receiver or horn and the speaker himself are perfectly synchronized and the human speech mingles with its electrical counterpart in complete unison. The nearby audience hears the speaker and the loud-speaker apparatus as if it were one voice, while those more distant hear only the latter.

During the war the loud-speaking telephone was adapted by the Bell System engineers to several different classes of military service. On



Diagrammatic View Showing Installation of Loud-Speaking Telephone in Convention Hall.

battleships such telephones were developed for transmitting orders. On the submarine chasers the loud-speaking system of telephony was extensively used in connection with the radio equipment and in detecting enemy submarines. Doubtless there will be many very valuable uses for the loud-speaking telephone, which will again demonstrate the leadership of American invention.

ELECTRICALLY DRIVEN PUMP IS SUPERIOR TO STEAM PUMP.

Approximately $1 per Capita Is Saved by Replacing Steam Pumps With Motor-Driven Pumps in Small Town.

The small water utility is a harder problem than the larger installation. If such a plant be steam operated in a town of from 2000 to 3000 population, the boiler load usually is very light and the firing periods infrequent, many times being at from 20 to 30-min. intervals. Usually old-style compound duplex pumps or even the simple pumps running non-condensing are found in such installations.

This is the state of affairs described by Charles Brossman in a paper recently presented before the Indiana Sanitary and Water Supply Association. He presented conditions found in the old water plant at Delphi, Ind., and told of a new installation of motor-driven equipment which cost, including both operating and investment charges, about $3600 per year less than the operating charges alone of the old plant.

A number of plans were proposed for the Delphi plant including the construction of a 150,000-gal. tank to provide storage so that the steam plant could be worked on an 8-hr. schedule. All these plans were thrown out for various reasons involving excessive costs, and electrical equipment was installed.

The original cost of operation with the old steam pumps was $4,827.50 per year. Using motor-driven pumps, making the plant automatic and cutting out all of the labor, it was estimated that the entire yearly cost would be less than $2000, making a saving in operating costs of $2800 a year. With interest and depreciation considered, the estimated possible saving amounted to a little under $2000 per year. Gasoline-engine-driven equipment was installed as emergency reserve to guard against a case of power failure.

The plant at Delphi is arranged with two 400-gal. Midwest two-stage diffusor pumps connected to 30-hp. Lincoln motors operating at 1440 r.p.m. and pumping against a pressure of approximately 60 lbs. per sq. in. These motors are not connected for series operation, but are used for all ordinary fire service. The reserve unit consists of a Midwest six-stage diffusor pump, good for a pressure of 100 lbs. per sq. in. at a speed of 750 r.p.m. This pump has a double source of power, being driven from one end by a 75-hp. Lincoln motor connected through a jaw clutch, and on the other end by a six-cylinder Wisconsin gasoline engine complete with electric starting equipment. In case of a breakdown the gasoline engine can be operated for fire pressure in which case it can be speeded up if necessary, or it can be operated at a lower speed and used for domestic pressure in case the power is off. The engine is turned over about once a week for a short time in order to be sure that it is in operating condition. The generator for charging the starting battery is connected to one of the domestic pumps so that it is always kept well charged and ready for starting.

As ultimately laid out, the entire cost of this equipment, including installation expense, was only about $11,000. The labor bill for maintenance and operation, which amounted to $1680 per year with the old equipment, was entirely eliminated by the operation of the new apparatus. The attention required is given by the superintendent of the waterworks, whose services are required with either system. Coal costs for the old plant were $3100 in 1917 and almost $4000 for 1918, with prospects of still higher bills for succeeding years. Costs for coal and labor in 1917 totaled almost $4800 and the same items in 1918 amounted to $5680. At a cost of $0.02 per kw-hr., the power required during the first few months' operation cost only about $40 per month. Later rearrangement of prices resulted in increasing the monthly bill to $75 or about the cost of wages that used to be paid to a fireman. Thus the entire operating expense of the plant is only about $900 per year, or $4780 less than the 1918 costs and $3900 less than the 1917 costs. These economies are sufficient to wipe out the investment charges completely in from two to three years. Other small towns are doing the same as Delphi has done, but there still remain many places where the small water-pumping plant is operated in the old and wasteful fashion.

DETERMINATION OF ELECTRICAL RESISTIVITY OF IRON.

At a recent meeting of the Iron and Steel Institute, A. L. Norbury discussed the effect of various elements on the electrical resistivity of iron, and gave a synopsis of the most important papers on the subject. He showed that the method of plotting the resistivity values of quenched carbon steels on a straight line, and extrapolating to 7.6 microhms as the resistivity of pure iron, could not be considered correct. Recent determinations gave 9.9 michroms per centimeter cube as the resistivity of pure iron at 20 deg. C. The results obtained by recent investigators showed that equiatomic quantities of different elements dissolved in iron did not increase the electrical resistivity to exactly the same amount. A new factor depending on the electronic properties of the particular element in solution determined the atomic resistivity increase in each case. The problem of calculating the electrical resistivity of a steel from its chemical composition was briefly discussed.

In a paper by Prof. C. A. Edwards and A. L. Norbury on the effect of heat treatment on electrical resistivity, it was stated that in the annealed condition the effect of chromium was to raise the resistivity of iron by 3.75 michroms for each per cent in excess of 4.3 times the carbon content. It appeared that the effect of chromium upon the resistivity of iron was to cause an increase of about 5.1 microhms per cubic centimeter for 1% held in solid solution.

EDITORIAL COMMENT

Educating the Public in the Use of Electricity

Almost everyone connected with the electrical industry admits that it is exceedingly difficult to acquire or understand the viewpoint of the layman who professes no knowledge of the subject of electricity and who is inclined to regard the thought of electricity itself as well as its accomplishments with considerable awe. It is true that what is known as electricity is surrounded with hypothesis, even among the world's scientists, and this fact may be the fundamental reason why the average layman regards electricity with so much apprehension and sometimes fear.

While danger, from the standpoint of fire as well as accident hazard, exists in connection with light and power circuits, and should not be overlooked or stand unappreciated by the users of electricity, still there remains, on the part of many of them, an undue antipathy toward the utilization of the many electrical conveniences that have been placed at the disposal of the public. Remaining unaware of the adequate means provided for the control and use of electricity, permitting it to be used in as safe a manner as possible, the layman who does not take advantage of the many opportunities for convenience afforded by electrical devices is at a distinct disadvantage when compared to the neighbor who is not so fearful. Strange as it may seem, especially to those in the industry, there remains a great many who really do fear the common use of electricity and who let that fear deprive them of its utility.

Eventually, we suppose, through the teaching of the fundamentals of electricity to the younger generation now in the schools and through the rapidly extending use of electrical devices, much of the timidity in connection with the use of the latter will be dissipated. However, that end is far from being accomplished, and there remains educational work to be done that will be helpful to the present generation. Central-station companies, electrical manufacturers, jobbers and contractor-dealers can do much in this direction in their publicity work if they will cease to take it for granted that the public is well acquainted with the mysteries of electricity, if they will make their literature more fundamental and simple, and if they will make their word-of-mouth explanations more thorough.

The attitude of the layman must be understood and appreciated in order that he may be served best and educated most; in short, we must "get his viewpoint."

Influence of the New Water-Power Law

Notwithstanding the publicity given to the question of hydroelectric development during the last ten or a dozen years by the almost endless hearings and discussions before numerous committees of Congress, there is no question but that legislation, or the lack of legislation, with adverse rulings of commissions, anti-trust laws and existing water-power laws have had a most regrettable effect upon the development of water-power sites.

With the signing of the so-called "Water Power Bill" by President Wilson, we may now look forward confidently to a new era—a period of rapid development of those power sites where the building of costly dams and the construction of large reservoirs will not be necessary, and a slower but certain development of other sites requiring more extensive engineering construction.

Without going into details or recalling the many stumbling blocks in the passage of this act, it may be well to recall that although the new legislation does not appreciably alter the procedure for developing water powers on privately owned land and non-navigable rivers, it is intended to remove the many long-standing difficulties in the way of utilizing power sites on public lands and navigable streams.

Out of very nearly 50,000 horsepower available on government lands or from navigable streams not more than about 4% is used at the present day. In view of the fact that when a less wasteful method of developing energy for power purposes is available, it is undesirable if not unreasonable to burn coal, the provisions of the new water-power bill will be appreciated not only by engineers but by all thinking persons who are capable of understanding the growing importance of saving coal and at the same time of providing greater power facilities as an aid to production.

The destruction due to the war has rendered imperative the increased production of necessary and useful commodities, but the high cost of coal, together with the uncertainty of obtaining it where and when required, renders doubly wel-

come the enactment of legislation which will encourage instead of retard the utilization of natural resources which up to the present have remained undeveloped owing to circumstances for which the engineer should not be held responsible.

Speeding the Decisions of Public Utility Commissions

It is one thing for a petitioner to get a hearing before a utility commission and another thing to get a reply from it. As a general rule the commissions are willing to listen to appeals from petitioners that have reasonable grounds for making them. But the commissions cannot, because of legal restrictions imposed or of other circumstances, always grant relief without making thorough investigations. These necessarily take time. Meanwhile the onerous conditions which are subject to complaint prevail. If the public is the petitioner, it becomes restive; if an utility, its business policy remains undecided. In both cases an unsatisfactory condition is admittedly existent that should be terminated with such speed as is consonant with clear thinking. For in this day of disturbed thought and diminishing income it behooves every individual and every organization to ameliorate disturbing conditions.

Every utility commission is charged with certain responsibilities implied or specified. Among them is the responsibility of acting with dispatch. Although this responsibility is generally catalogued in the former of the two classes, it is none the less important. Two parties, namely, the public and utility company, are at interest in every problem that a commission considers. Their rights and privileges are equally balanced. Neither has tantamount claims for consideration. Both are entitled to consideration—and speedy consideration. If one unnecessarily prolongs or delays the hearings in which it is a party or is delinquent in submitting evidence, it should be made to understand that its delinquency is evidence adverse to its claims.

Likewise, the commissions should be impressed with the knowledge that procrastination defeats the purpose for which they were created. To delay unnecessarily the issuance of a decision on a matter in which an utility is a petitioner causes business instability; a similar delay when the public is the petitioner destroys public confidence in a commission. No doubt the utility commissions function more rapidly than any other governmental organizations. Perhaps most of them are functioning as rapidly as legal restrictions will permit. If such is the case, however, those of them who see their dockets full of more petitions than they can dispose of expeditiously should ask for legislation that will permit them to make more rapid progress than they are making.

One of the most important characteristics of this country is its growth. This means increased population, increased business, more public utilities and more people using their service. Does it not also mean more work for the commissions? Are the members of the commissions making provision for this increased service? The commissions are given a nonpartisan status so that they may enjoy the confidence of those for whom they are mediators. But confidence in them suffers when they are accused of procrastination.

Store Arrangement and Merchandising

Floor plans for an electrical store, when conceived in theory and designed on paper, appear enticing. One can almost visualize the crowds of patrons pressing into the store, and the steady stream of currency flowing into the already heavily burdened cash register. That, at least, is how it might appear to the optimistic young enthusiast studying his first plans.

Securing of patronage for a retail store, however, is not alone a matter of diagramatic planning. In fact, pencil and paper designing of merchandise layouts has very little to do with success beyond the initial step for a trial plan. Ultimate success of the average contractor-dealer may be attributable to some one or more good methods born of many trials and stubborn perseverance.

As a target to aim at, or a point to work from, the floor plan fulfills a mission. The contractor-dealer considers his location, dimensions of merchandising space, quantity and quality of natural light, class and bulk of merchandise to be handled and some other details. Then, with or without putting his plan on paper, he makes his first arrangement and distribution of goods and stations himself at the entrance to welcome the patronage.

If the first layout of the store is a success, which it seldom is, the dealer strives to emphasize and improve it. If it is not successful within the bounds of modest expectations after a trial of several weeks or months, the persevering dealer rearranges his layout. Perhaps the next plan is radically different. If success does not come with that plan, he tries another, and continues to try until, at last, he wins—and he is bound to win if he keeps trying. Those who fail frequently lack the courage to stem the tide of reverses. Chief among those who succeed are those who co-operate with fellow dealers.

CURRENT EVENTS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

NEW YORK CONTRACTOR-DEALERS HOLD CONVENTION.

Annual Meetings of State Association at Utica Occupied With Many Papers on Merchandising Subjects.

Merchandising in the aspects that affect the retail industry were the principal subjects discussed at the annual convention of the New York State Association of Electrical Contractors and Dealers, held at Utica, N. Y., June 24-25, with a large attendance of delegates and visitors from all parts of the state.

The morning session, June 24, was devoted to a meeting of the executive committee, followed by a business meeting of the members in which trade conditions were discussed. At the afternoon session, following an address of welcome by James K. O'Connor, mayor of Utica, and a response by W. C. Peet, chairman of the National Association of Electrical Contractors and Dealers, papers were presented on "Effects From the Central-Station's Viewpoint of Co-operative Selling Campaigns," by Frank B. Steele, vice-president of the Utica Gas & Electric Co.; "Teaching Your Dollars to Have More Cents," by William J. Shore, and a report on the work of the national association by W. H. Morton, general manager of the National Association of Contractors and Dealers.

The second day's sessions were given over to papers on the following subjects: "A Two Billion Dollar Industry," by H. B. Kirkland; "Harmonizing the Industry," by Samuel A. Chase; "Co-operation Between the Central-Station Company and the Contractor-Dealer," by Stanley A. Dennis; "Silk Purses and Sow's Ears," by W. E. Robertson, and a general discussion on "Scientific Merchandising," led by William L. Goodwin.

The chief feature of the entertainment end of the convention program was the annual banquet, June 24, followed by an illustrated lecture by Solomon Davis, past president of the New York States Association of Electrical Contractors and Dealers, who recounted his experiences during a recent trip to Japan.

IOWA SECTION OF N. E. L. A. HOLDS ANNUAL MEETING.

Papers on Inductive Interference, State Regulation and Customer Ownership Among Those Featuring Annual Convention.

The nineteenth annual convention of the Iowa Section of the National Electric Light Association was held at Colfax, Ia., June 23-25, with headquarters at the Colfax Hotel. The convention was opened Wednesday morning with the report of President M. H. Simonds, Dubuque Electric Co., and was followed by the report of Secretary-Treasurer M. G. Linn, Des Moines Electric Co. The remainder of the session was devoted to reports of committees and a discussion on "In What Way Can the Association be of More Value to Its Members?"

A special report of the farm line committee was made at the afternoon session by John M. Drabelle, Iowa Railway & Light Co., Cedar Rapids. Mr. Drabelle also made a report for the inductive interference committee, this report being followed by a discussion on "Interference Between Telephone and Electric Transmission Lines in Iowa."

Thursday's sessions were devoted to papers and discussion on "Valuation and Rate of Return," by B. J. Denman, United Light & Railway Co., Davenport; "The Determination of Electric Service Rates," by W. J. Greene, rate engineer, Cedar Rapids; and discussions on "Municipal vs. State Regulation of Electric Public Utilities in Iowa," on "Fire and Liability Insurance for Public Utilities," and on "The Unprofitable and Undesirable Customer."

At the final sessions Friday a paper on "Customer Ownership of Public Utility Securities," was read by E. V. Graham, manager of the stock and bond department of the Middle West Utilities Co., Chicago. The convention was closed with the election of officers and a discussion of the plan of forming an Iowa Committee on Public Utility Information along the same lines as the committees now at work in other states.

A full report of the convention will be given in next week's issue of ELECTRICAL REVIEW.

SIGNING OF WATER-POWER BILL TO BENEFIT UTILITIES.

Will Result in Speedy Development of Many Sites Hitherto Not Available for Use of Private Corporations.

With the water-power bill made a law by the action of President Wilson in signing it, public utility companies in all parts of the country, especially in the New England and Pacific Coast states where waterways capable of development are more numerous than in other parts of the country, are beginning to take stock of just what the enactment of the bill into a law means to them.

Above everything else, passage of the bill means a more speedy development of all water power that is naturally available, or, in other words, water power that can be converted into electrical energy without long processes of work such as the building of dams, storage reservoirs or any of the other methods used where water

power is found but is not naturally ready for use.

There is plenty of undeveloped natural water power, much of it being on government reservations that, with certain restrictions in the water-power law, will now be turned over for development. Practically all of this water power lies in the western states, most of it being west of the Rocky mountains.

That the enactment of the water-power law means that much of this sort of water power will be quickly developed there is no question and similarly, though, of course, through a slower process, will come the development of all sites where water power is available through the use of dams, storage reservoirs or other methods.

With the status of all water power in the United States established by the new law it is expected that capital for its development will be more easily obtainable by the public utilities companies planning to make use of the power. In the case of privately owned property the procedure for the development of water power will be exactly the same as in the past, the developing company having to make whatever arrangements are necessary with the owners, either through purchase of the land abutting the water power outright or by lease, rental or some other method.

Where the water power desired lies in government lands the procedure will be different, as in that instance the authority over the water power will be vested in a commission consisting of representatives of the government departments interested in government lands and waterways. One of the outstanding differences of opinion during the conferences over the bill was over the question of whether the engineer of this commission should be an army engineer or one from civil life. It was finally decided to have the appointment go to an engineer in civil life.

Another point that caused long conferences between the House of Representatives and the Senate committees in charge of the water-power bill was over the compensation to be paid for the use of water powers on government lands by private corporations. The House committee originally wrote into the bill that the public corporation, or "licensee" in the terms of the bill, should pay reasonable annual charges in an amount to be fixed by the commission. It also provided that when licenses were granted that contemplated the use of government dams or other property owned by the United States in the discretion of the commission the charges paid by the licensee might be adjusted at the end of 20 years after the beginning of operations and at periods of not less than 10 years thereafter. The Senate changed this section. After long debate the Senate change was allowed to stand, and the bill now provides:

"The licensee shall pay for the license granted such reasonable annual charges as may be fixed by the commission for the purpose of reimbursing the United States for the cost of administration of the act in relation to water powers developed under its jurisdiction in the proportion that the water power developed by the project covered in said license bears to the total water power developed by all projects licensed under the act, and for that purpose such charges may be readjusted from time to time, not oftener than once in two years; the licensee shall also pay for the use and occupation of any public lands and lands in reservations, except tribal lands embraced within Indian reservations, necessary for the development of the project covered by the license such reasonable annual charges based upon the actual value of the government lands used as may be fixed by the commission, but in no event shall the annual charge for the foregoing exceed 25 cents per developed horsepower, provided that when licenses are issued involving the use of government dams or other structures owned by the United States or tribal lands embraced within Indian reservations the commission shall fix a reasonable annual charge for the use thereof, and such charges may be readjusted at the end of 20 years after the beginning of operations and at periods of not less than 10 years thereafter in a manner to be described in each license."

The law, as passed, apparently is clear as to just what use can be made of water power on government lands and it is expected that as soon as the commission is appointed and organized there will be numerous companies seeking rights in the territories in which they operate. As stated before, much of the water power on government lands, and practically all of the so-called

Delegates in Attendance at the First Annual Convention of the North Central Electric Association, One of the New

natural water power is located in the Pacific Coast states, where water-power development has for a long time been making greater strides than in any other part of the company. It would appear that it would be a comparatively easy matter to link up with some of the existing water-power systems of California, Washington and Oregon much of the water power now undeveloped on government lands in that territory.

The signing of the bill by President Wilson recently ended a fight for water-power legislation that has been going on continuously for more than a dozen years, and one that has been before every session of Congress since 1910. Twice bills were passed in different forms by both houses of Congress and sent to conference committees and once, in the 1918 Congress, an agreement was reached by the conference committee, but later this bill failed of enactment by both the House of Representatives and the Senate.

Pending legislation that would cover the matter and provide a legal status for water-power development has been the reason that development has been largely at a standstill. Some powers have been developed within the past 10 years, but the aggregate is but a small percentage of what could and would have been developed had it not been for conditions which first had to be corrected by legislation.

Before the passage of the law water-power sites fell within two classes: First, those privately owned on non-navigable streams, and, second, those on public lands or on navigable streams. The first named sites could be developed by the owners after complying with local laws. The second named could not be developed without a permit from the United States, and under the laws existing up to the time of the signing of the water-power bill the United States could not issue permits that were worth having. They could not confer titles on which money could safely be invested in the necessary construction and business.

How the foregoing stopped water-power development can be easily explained. The water-power capacity of the United States, not considering storage, is about 60,000,000 hp. Of this amount only 14,000,000 hp. comes under the head of privately owned sites, while 46,000,000 hp. comes under sites on public lands or on navigable streams. And although by far the largest amount and the best water powers are in this latter class, less than 4% being utilized, while of the privately owned sites about 25% has been developed and is in use. A development of 25% at private sites may be considered reasonably adequate, while a development of only 4% at public sites is grossly inadequate.

The new water-power law corrects this condition and makes it possible, as soon as the necessary machinery has been put in motion by the appointment and organization of the water-power commission, to develop the water power on government lands just as rapidly and with just as large degree of confidence, as far as titles to property and other things necessary to insure the financial integrity of the proposition are concerned, as it has been in the past to develop water power on privately owned sites.

NORTH CENTRAL ELECTRIC ASSOCIATION CONVENES.

New Geographic Division of National Electric Light Association Holds Successful Meeting at Minneapolis.

Fuel supply in the Northwest, especially as it is affected by transportation problems, was one of the chief topics of the closing sessions of the North Central Electric Association held at the Radisson Hotel, Minneapolis, Minn., June 15-17. A comprehensive paper, presented Wednesday by Henry D. Thrall, vice-president o the Minnesota Loan & Trust Co., on the financial situation as affecting utility companies, paved the way or a discussion on another equally important problem, that of the fuel situation. Thursday's Crocker, who introduced Mr. Saunders, of the Crocker, who introduced Mr. Saunders, o the Northwest Fuel Co., Minneapolis, who spoke in place of M. H. Groverman, secretary of the Northwest Coal Dock Operators' Association, the latter being unable to be present at the meeting. Mr. Saunders dealt particularly with the fuel situation as affected by the movement of coal by boat to the head of the lakes. He emphasized the necessity of sufficient dock coal in order to supply the Northwest during the coming winter, and said at present there should be 4,000,000 tons of coal in storage at

GeographicSections Formed Under the Reorganization Plans Recently Approved by the National Electric Light Association.

Lake Superior points instead of the 50,000 tons there now. Over 10,000,000 tons will have to be shipped by vessel before the close of navigation to satisfy the demands of Minnesota, North and South Dakota. Referring to the rail movement of coal, Mr. Saunders spoke of the Interstate Commerce Commission order calling for the return of open-top cars to the railroads owning them. This will relieve the situation to some extent, but there is needed a system of priority orders for coal shipment and a preferential car supply. The labor situation in the coal fields is not encouraging on account of low production which is caused by lack of cars for shipment.

The discussion brought out a suggestion for the appointment of a committee by the association to handle the coal situation for the central-station companies, to suggest means for conservation, better combustion, and a zoning system for coal distribution. Utilization of lignite coal was discussed, points being made that there is a vast supply in North and South Dakota close at hand, but that trouble is experienced in constructing boiler settings suitable for the burning of lignite; also that lignite is poor fuel when peak loads are encountered.

W. P. Trickett, general manager of the Minneapolis Traffic Association, spoke of the transportation situation in the Northwest. He said a serious car shortage exists in that section, that conditions were 25% of normal, but were improving slowly. While he agreed that an adequate supply of coal for the utility companies was imperative and that cars should be provided for that purpose, he stated it was the first consideration to move the grain and grain products of the Northwest.

"Present Day Conditions and Tendencies in the Development of Domestic Electric Cooking" was the title of papers presented by H. A. Dahl and Miss Bernice Bell of the electric cooking bureau of the Minneapolis General Electric Company. Points were brought out emphasizing the utility of the electric range from the standpoint of the consumer and the profit to be made from the standpoint of the central-station company. Milton Henock, Westinghouse Electric & Manufacturing Co., in discussing the paper, said that fear of fuel shortage should not discourage central-station companies in placing electric ranges on their lines, in view of the fact that the fuel situation would undoubtedly be relieved. P. L. Miles, Edison Electric Appliance Co., spoke of the profit in the range business, of the difficulties manufacturers are having in maintaining production, and gave statistics on the number of ranges in use.

The following officers were elected: T. D. Crocker, Minneapolis, re-elected president; O. A. Rofelty, Sioux Falls, S. D., re-elected vice-president, and F. C. Hoffman, St. Paul, re-elected treasurer. The new executive committee consists of W. N. Ryerson, Duluth, Minn.; W. C. Blanchard, Aberdeen, S. D., and M. L. Hibbard, Fargo, N. D.

Entertainment for the delegates consisted of a trip in chartered street cars to Lake Minnetonka Wedneeday evening, and a banquet and vaudeville show Thursday evening.

ILLINOIS COMMISSION DISCUSSES RURAL LINE RULES.

Holds Hearing for the Purpose of Formulating Rules Governing the Construction, Operation and Maintenance of Such Extensions.

Discussion of rules for the construction, ownership and maintenance of distribution circuits in rural districts took place at a hearing before the Illinois Public Utility Commission, June 10. It is provided in the rules that where rural consumers have formed a corporation for the construction of lines to serve applicants along the route a public utility company must refuse to connect the circuits of the new company until it has filed rates and obtained a certificate from the commission.

In the case of a mutual organization furnishing consumers without profit, the company furnishing energy must make certain that the construction installed by the mutual company meets the requirements of the rules for overhead construction. Where the consumers receive service as individuals it must be arranged that the title to the necessary lines and equipment when completed will be in the electric public utility, which must be responsible for their maintenance and operation.

Before extending its service into rural territory or connecting to any distribution circuit the utility furnishing energy must file rate schedules with the commission and a statement describing the lines to be constructed, give the proportion of cost to be borne by the consumers, a statement concerning the ownership, maintenance, operation and replacement of the lines and equipment and an explanation of the basis upon which additional consumers will be served.

Rates to individual rural consumers shall consist of a service charge and an energy charge, the latter to cover the excess cost over service in towns and cities.

CHICAGO CIVIC ORGANIZATIONS URGE UTILITY RELIEF.

Representatives of Eight Bodies With Combined Membership of Over 16,000 Make Appeal to Illinois Public Service Commission.

Representatives of eight civic clubs and business organizations of Chicago having a total of over 16,000 members, presented a petition to the Illinois Public Utility Commission last week urging that immediate relief be granted the various public utility corporations now asking for permision to raise rates.

The petition points out the great need for relief in order that the present unsatisfactory public service be not made worse or suspended entirely. The petitioners urge, however, that in giving relief the commissioner make the increase granted only temporary in character.

Attention is called to the financial status and needs of the utilities, which are said to prevent even the stronger companies from obtaining necessary additional capital except at exceedingly high rates of interest.

The commissioners allowed the petition to be filed and promised to give it consideration. The

petition was adopted by each of the associations represented and signed by R. J. Kane, president of the Chicago Association of Credit Men; Moses E. Greenebaum, president of the Citizens' Association of Chicago; Howard Elting, president of the Commercial Club of Chicago; William Nelson Pelouze, president of the Illinois Manufacturers' Association; Robert F. Carr, president of the Industrial Club of Chicago; Wyllys W. Baird, president of the Chicago Association of Commerce; E. S. Buckmaster, president of the Traffic Club of Chicago, and John Fletcher, president of the Union League Club of Chicago.

ELECTRICAL EXPORTS SHOW HEAVY DROP IN APRIL.

Total Amounts to $6,954,350, a Decrease of Almost $800,000 from Figures for the Same Month Last Year.

Exports of electrical goods to foreign countries for April showed a heavy drop over the figures for April, 1920, the figures being $6,954,350 for this year, against $7,732,041 for last, a decrease of $777,691.

For the first ten months of the government fiscal year, which ends June 30, 1920, the total exports amount to $69,244,187, an increase of $7,240,212 over the 1919 figures and of $24,730,-124 over the 1918 total. The figures above are taken from the monthly summary prepared by the United States Bureau of Foreign and Domestic Commerce. The following classified figures give the detailed data for April, 1920, compared with the corresponding month last year:

Electrical machinery and appliances:	April 1920	April 1919
Batteries	$487,472	$547,430
Carbons	84,967	102,642
Dynamos and generators	636,362	512,894
Fans	149,728	96,433
Heating and cooking apparatus	140,715	153,342
Insulated wire and cables	526,556	789,991
Interior wiring supplies, including fixtures	308,091	218,031
Lamps—		
Arc	698	2,889
Incandescent—		
Carbon filament	11,514	13,100
Metal filament	352,669	452,151
Magnetos, spark plugs, etc.	310,744	312,188
Meters and measuring instruments	181,663	248,890
Motors	923,096	829,113
Rheostats and controllers	66,289	30,798
Switches and accessories	272,680	230,840
Telegraph apparatus, including wireless	44,394	106,769
Telephones	326,497	426,373
Transformers	169,976	308,669
All other	1,960,139	2,349,498
Total electrical machinery, etc.	$6,954,350	$7,732,041

OHIO CENTRAL-STATION MEN MEET AT CEDAR POINT IN JULY.

Long Program of Papers and Discussions Has Been Arranged for Annual Convention of State Electric Light Association.

Arrangements have been completed for the annual convention of the Ohio Electric Light Association to be held at Cedar Point, O., July 13-16, with headquarters at the Breakers Hotel. The convention will be opened Tuesday, July 10, with the reports of the president, secretary and treasurer and a round-table conference on the work of the association. The report of the illumination committee will be presented by G. S. Merrill, Cleveland, O., followed by an address on "Taxation of Utilities," by C. Dalton, Toledo Railways & Light Co.

Wednesday's sessions will consist of the report of the station operating committee, submitted by Henry B. Dates, Cleveland, O., a paper on "Operating Trouble," by C. W. DeForest, Union Gas & Electric Co., Cincinnati; a report of the transmission and distribution committee by W. E. Beaty, Cincinnati, and an address by William McClellan, vice-president of the Cleveland Electric Illuminating Co.

On Thursday the report of the new business co-operations committee will be presented, C. G. Eichelberger, Cincinnati, making the report for the lighting and merchandising section, while J. C. Mattheiu, Dayton, will report for the power and heating section. J. L. Wright, Toledo, O., will submit the report of the meter committee, the session closing with an address by George H. Cushing, managing director of the American Wholesale Coal Association, Chicago. The convention will be concluded on Friday with an address on "Heat Treatment of Steel," by R. T. Kaighan, of the Cleveland Electric Illuminating Co., and the election of officers.

Elaborate arrangements for entertaining the delegates and visitors have been made by the convention committee, the program including dancing and card parties as well as athletic and aquatic events of all kinds.

ENGINEERS ASKED TO INDORSE NEW CLASSIFICATION PLAN.

Engineering Council Committee Sends Letters to 100 National and Local Organizations Asking Support for Movement.

The classification and compensation committee of Engineering Council, on June 9, addressed a letter to the secretaries of each of approximately 100 national or local engineering and other technical societies. Formal endorsement by the governing body or by the society as a whole of the classification adopted by Engineering Council is asked, to the end that it may become generally recognized and put into effect. As to the suitability of the scale of compensation and the employment policy tentatively suggested, the committee desires an expression of views both of the societies and of individual members thereof.

To date several societies have taken action in regard to this matter. The Municipal Engineers of the City of New York, on May 26, endorsed the classification and adopted a schedule providing for compensation at a rate approximately 20% greater than that tentatively suggested by Engineering Council's committee. The classification has been closely followed by the congressional joint commission on reclassification of salaries in its recommendations concerning engineers in the federal service. It was approved on April 13, by the executive committee of the American Society for Testing Materials. The Boston Society of Civil Engineers made the endorsement of the tentative schedule of compensation the subject of a letter ballot by the full membership, which is now being canvassed.

Thus it will be seen that substantial progress has been made in bringing about a recognition of Engineering Council's classification plans as standard.

The committee has been reorganized and is now made up as follows: Arthur S. Tuttle, chairman, 1347 Municipal building, New York City; Charles Whiting Baker, secretary, 31 Nassau St., New York City; Frederick W. Cappelen, Minneapolis, Minn.; Philip P. Farley, Brooklyn, N. Y.; O. C. Merrill, Washington, D. C.; C. A. Morse, Chicago; M. M. O'Shaughnessy, San Francisco, Cal.; R. S. Parsons, New York City; and Edmund I. Mitchell, New York City.

WESTINGHOUSE EMPLOYES' STORE PROVES SUCCESSFUL.

Nearly a quarter of a million dollars in cash sales was handled by the employes' store of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., in the first five and one-half months of its existence, states a recent announcement.

According to a report just issued by J. E. Bonham, secretary-treasurer of the co-operative buying committee of employes, the total sales amounted to $226,673. After expenses for the period were deducted there remained a surplus of $11,550 which is being used as a working fund.

The employes' store has been in operation since October 18, 1919, selling merchandise practically at cost to workers. It is the intention to enlarge the capacity of the store as the patronage of the employes warrants.

Business was transacted in grocery, tailoring, shoe and miscellaneous departments, more than nine-tenths of the total sales being made by the grocery department. The tailoring department sales totaled $8112.91, the shoe department sales were $6341.85 and $9665.57 was obtained in sales of miscellaneous goods.

NEW CONSTRUCTION RULES TO BE ENFORCED FAIRLY.

The following quotation is taken from a leaflet issued by the Department of Gas & Electricity, City of Chicago, and refers to new rules adopted and to become effective on July 1, 1920. The rules, together with the comments of the department pertaining to their interpretation, appear on page 1075 of this issue:

"It is not the intention in the enforcement of these rules to place any undue hardships on contractors, dealers or manufacturers by requiring them to dispose of such apparatus as may not comply with the rule and which they may have on hand. However, in justice to such contractors, dealers and manufacturers, the department cannot permit, for any extended period, the use of apparatus not complying with the rule. Contractors, and dealers located in the city, may, therefore, submit to the department statements showing in detail the apparatus in stock. Limited amounts of this apparatus may be allowed to be used. These statements should be made under oath and should show that such apparatus as is listed was purchased previous to the issuance of the 1919 edition of the Electrical Code of this department. The department also reserves the right to allow such variations from the rules stated as may be deemed advisable."

OFFICERS ELECTED BY ELECTRICAL MANUFACTURERS' COUNCIL.

A meeting of the Electrical Manufacturers' Council was held in its new office, 522 Fifth avenue, New York City, on June 18. Officers were elected for the ensuing year as follows: Chairman, S. L. Nicholson, Westinghouse Electric & Manufacturing Co.; vice-chairman, LeRoy Clark, Safety Insulated Wire & Cable Co.; treasurer, E. B. Hatch, Johns-Pratt Co.; executive secretary, Frederic Nicholas.

The office of vice-chairman is a new one, authorized by a change in the constitution approved at a meeting on June 18. It was created because of the expansion in the work of the council in connection with the establishment of headquarters in New York City. Mr. Nicholson and Mr. Hatch were re-elected to the same positions which they had held.

COMING CONVENTIONS.

American Institute of Electrical Engineers, Annual convention, White Sulphur Spring, W. Va., June 29-July 2. Headquarters, The Greenbrier. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 13-16. Secretary, D. L. Gaskill, Greenville, O.

Pacific Coast Section of the National Electric Light Association. Annual convention, Portland, Ore., July 21-23. Chairman, R. M. Boykin, Portland, Ore.

Michigan Section of the National Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-26. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 8-11. Secretary H. M. Stine, 211 Locust street, Harrisburg, Pa.

New England Section of the National Electric Light Association. Annual convention, Kineo, Me., Sept. 13-16. Secretary, O. A. Bursiel, 149 Tremont street, Boston, Mass.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 4-8. Headquarters. Southern Hotel, Secretary, W. H. Morton, 110 West 40th street, New York City.

NEW YORK CONTRACTORS TO HOLD ANNUAL OUTING.

The Independent Electrical Contractors' Association of Greater New York will hold its sixteenth annual outing at Grant City, Staten Island, July 24, the purpose of the outing being to promote good fellowship in the electrical fraternity. Following a shore dinner there will be games, including a baseball game between the New York City department of water supply, gas and electricity and the New York Board of Underwriters teams.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

WOULD TAKE 10 YEARS TO REBUILD ILLINOIS UTILITIES.

If the properties of electric light and power, telephone, gas, and electric railway companies in Illinois were destroyed, it would take 10 years of steady labor to rebuild them, according to expert testimony recently placed before the Illinois Public Utility Commission. Plants now in use cost the tremendous sum of $1,200,000,000 to build and it would take approximately two billions of dollars at present materials prices to duplicate them. At the present time there are approximately 270,000 utility securities holders in Illinois, they with their families representing over 1,000,000 of the state's population.

COMPARES PROPER AND IMPROPER LIGHTING OF FACTORIES.

Commonwealth Edison Co., Chicago, Installs Model Industrial Plant That Attracts Many Visitors to Demonstration Room.

A good comparison between the proper and improper lighting of industrial plants and factories is made by the Commonwealth Edison Co., Chicago, in a display now on exhibition in three large rooms at the company's main office and salesroom.

The display consists of two fully equipped rooms in a machine shop that well represent the average of such rooms in any industrial plant. The visitor is first shown the improperly lighted room equipped with open incandescent lamps, hung from cords from the ceiling, some of them equipped with old style reflectors that throw the light almost every place except where the workman needs it. The machines and work benches are generally in deep shadow, or else the light is so placed that the workman himself throws a shadow on the work bench, or is forced to work with a glaring light in his eyes.

The next room shows the same style of machinery, but with modern lighting effects. The difference on walking from the one room to the other is startling. In the room lighted with modern equipment there are no shadows noticeable, glare is almost totally absent and every part of the machinery and work bench is fully lighted.

In this room half a dozen different types of fixtures and lamps have been installed so that the benefit of direct, semi-direct and localized lighting effects can be demonstrated. In addition, printed charts and diagrams on the walls are so arranged that the effects of glare and shadows can be adequately and fully explained to interested persons. These charts also show

Charts, combined with Modern Lighting Effects, Show Graphically How to Properly Light a Workroom.

Improperly Lighted Workroom in Commonwealth Edison Exhibit, Chicago.

a comparison of costs between the proper and improper lighted industrial plant, including the increased production figures that were obtained by the Commonwealth Edison Co. in a recent survey made of Chicago industrial plants.

POWER-PLANT INDUSTRY OF WORLD RAPIDLY GROWING.

The power-plant industry of the world is growing rapidly, not only in magnitude but, fortunately, in the efficient use of natural resources, according to information gathered by the Illinois Committee on Public Utility Information. A survey of the important undertakings in various countries reveals how widely the problems differ in various localities. England, with her coal mines, is planning super-power stations; Holland, without coal and water power, expects to develop wind power to the limit; Norway, Sweden and Finland will use water power more extensively; Russia is expected to develop peat bogs; Spain will be a network of transmission lines connecting water and steam plants with industrial centers; Italy has her natural volcanic steam. All of these countries are investing heavily in order to develop power.

Before the war human labor in Europe was cheap, and hence many of the processes done in this country mechanically were there done by hand. Now this condition has changed, and the demand for power has increased for this reason as well as for the expected increase in industrial output. In this country the necessity of developing more power per pound of fuel is now recognized, both because of higher coal prices and because of the need of more economic production.

ORGANIZATIONS GAIN ADVANTAGES BY WORKING TOGETHER.

Advertising and Publicity Service Bureau of N. E. L. A. and Society for Electrical Development Work in Harmony.

Lines of helpful co-operation for the benefit of the electrical industry are now in splendid working order between the advertising and publicity service bureau of the National Electric Light Association and the Society for Electrical Development, Inc. Many distinct advantages of this co-operation are already in evidence, chief of which is the clearer appreciation of the great field in which both may work together, and of the ease with which the facilities of the two organizations can be used to mutual advantage.

Plans of co-operation have been arranged so that each organization advises the other, in advance, of any intention of publishing booklets or carrying on special advertising or publicity work, so that such publication or other work is discussed and agreements are reached, which forestall any inadvertent duplication.

In many cases, such as the work connected with electrical newspaper pages, national advertisers' copy, motion picture plays or special campaigns, the two organizations now formulate plans which will enable them to co-operate and thus broaden the scope and enhance the value of the work.

COOLIDGE URGES RATE INCREASE FOR UTILITY SECURITIES.

In a special message to the Massachusetts legislature, Governor Coolidge declares that the rate of interest on public utility securities should be increased in view of the present high cost of money and inability of such companies to issue securities at rates which will attract new capital. The legislative ways and means committee will report a bill to this end. The message says:

"Several of the gas and electric light companies find it necessary to finance themselves to provide for meeting maturities on notes and bonds. They are unable to sell stock and bonds on this market without paying above the present legal rate.

"There are two courses open—to increase the charge made to the public for gas and electric light service to such an extent as to insure returns considerably in excess of what has heretofore been the policy, or to provide temporarily for financing at an interest charge in excess of present rates. It seems perfectly apparent that the public welfare would best be served by the latter course. If this be done, it will no doubt result in a considerable saving to the public."

Model Factory Room at Commonwealth Edison Co., Chicago, Where Six Types of Modern Industrial Lighting Are Shown.

CONTRACTING-CONSTRUCTION

A Department Devoted to Various Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

RIGID AND FLEXIBLE CONDUIT IS USED TOGETHER.

Chicago Housing Association Design Presents an Interesting Example of Simplicity in Electric Construction Work.

Extreme economy, combined with simplicity of treatment and ruggedness, features the electrical work, as well as other elements, in the erection and equipment of the workingmen's homes now under construction near 88th and State streets, Chicago. These houses, of which there are now 175 under construction, are all being wired for electric light. There is only one outlet per room provided excepting in the combination kitchen and dining room where two ceiling outlets are installed, one being located over each end of the room. All units will be controlled from the fixture, there being no provision for wall switches or outlets.

An interesting feature of the construction work is to be found in the use of flexible conduit, a section of which is shown in the accompanying illustration. This conduit is used to run across the joist from the pantry outlet, where the basement riser terminates, to a point where another outlet is provided, and from which the rigid conduit may be run between joists. The flexible conduit is pulled through holes drilled in four of the joists. This type of construction makes it unnecessary to either notch the floor-supporting structure or to take

Flexible Conduit Used to Make Runs Across Joists.

the time required to properly bend a rigid pipe to fit in a slot through the rough floor. Thus the advantage of such construction practice is structural rather than electrical. The illustration shows the use of iron straps for the support of outlet boxes. These straps are used on all boxes, whether located under or between joists. Additional support is given the outlet box by the wood cross-brace shown fastened between joists and under the section of rigid conduit.

CITY ELECTRICAL DEPARTMENT INTERPRETS RULES.

Leaflet Issued by Electrical Inspection Bureau of City of Chicago Quotes Existing Rules and Makes Interpretations.

A new rule relative to the inclosing of live parts goes into effect in Chicago on July 1, 1920. This rule, which was first announced as effective on Jan. 1, 1920, was held over to avoid placing too heavy a burden on manufacturers and contractors. The rule, together with the comments of the department is as follows:

"*Inclosing Live Parts.*—All exposed live parts of apparatus must be guarded against accidental contact either by the provision of suitable inclosures or by so locating the apparatus that only electricians duly qualified to handle the same can come in contact with it.

All apparatus, with exposed live contacts which in their ordinary operation produce arcs, must be provided with suitable inclosures or so located that nothing of a combustible nature will be in close proximity to the same.

This rule shall not apply to trolley wires or other exposed live parts which from the nature of their use cannot be inclosed.

It is the intent of this rule to require such protection of live parts of electrical apparatus as will eliminate, as far as possible, both accidents from contact with live parts and fires which may result from sparks or flames produced in the operation of electrical apparatus.

The protection of live parts against accidental contact will be required on all apparatus where a person not familiar with electrical apparatus may accidently come in contact with such live parts.

The protection for arcing will be required on all apparatus so situated that such arcing contacts might produce fires.

Protection of live parts may be obtained by so locating apparatus that the live parts are not easily accessible to the ordinary workman. This may be accomplished by elevating the apparatus 8 ft. or more above the floor, by locating the apparatus in an engine room or other location when accessible only to authorized electricians.

Protection of arcing contacts may be obtained by locating such arcing contacts in fireproof locations where there is no liability of combustible material being placed near them.

Where there are live parts which cannot be protected by location as described above then such live parts must be provided with such inclosures as will accomplish the purpose of the rule. It is intended that the inclosure referred to will be provided in the design of the apparatus and by the manufacturer.

EFFECT OF RULES ON VARIOUS CLASSES OF EQUIPMENT.

The effect of the rule on various classes of apparatus, where such apparatus cannot be protected by its particular location as described above, is herewith given:

Terminals of Apparatus.—Exposed binding posts must not be used unless all live parts of both binding post and connections to the same are so insulated that contact cannot be accidently made with the live parts.

For portable apparatus using flexible cord connections, the conductors may enter the apparatus and be connected directly to the interior conductors, if provided with a means of strain relief, or a separable plug

may be used with the connecting cord terminating in the separable part.

For non-portable apparatus, used in the City of Chicago, connection is usually made to wires in conduit. The apparatus may be designed for the direct entrance of the conduit to the interior of the apparatus and the connection of the conductors to interior binding posts or conductors. The conduit being secured to the apparatus will ground it as is required by the rules. A junction box may be attached to the apparatus frame and connections made within it.

Motors.—Commutators must be protected against accidental contact. This may be accomplished by guards so designed that accidental contact cannot be made with live parts, or by a special design of the motor itself. Where protection of arcing contacts is required, the commutator must be so inclosed that sparks from the commutator cannot get outside the inclosure. If wire mesh or gauze guards are used they must be attached to the motor by spring hinges. This ruling applies to motors of all sizes including the smaller types of motors used on electric fans and the various motor-operated appliances.

Starting Boxes, Etc.—Manually-operated starting boxes, speed controllers and the like must be so designed that the device can be operated from the outside of the inclosure. This protection must be obtained by the design of the device. The placing of a manually-operated starting box inside a metal cabinet, where it is necessary to open the door of the cabinet to operate the device, does not comply with the rule.

Automatic starting boxes and similar devices may be placed in standard cabinets provided with hinged doors.

Automatic-Control Boards. — Automatic-control boards, including automatic elevator controllers and similar devices, unless placed in fireproof locations and guarded (by screens or location) so that unauthorized persons cannot make contact with same, must be placed in metal inclosures.

Auto-Starters, Compensators, Etc.—Where there are no exposed live parts no special protection is required. Where no-voltage or overload coils having exposed contacts are used such contacts must be inclosed.

Resistance Grids.—All types of resistance grids must be protected against accidental contact either by location or by suitable ventilated inclosures.

Circuit-Breakers.—Circuit-breakers must be inclosed in metal cabinets and, if used in place of a switch, must be arranged to be operated from the outside of the inclosure.

Special Panel Boards.—Special panel boards such as dental boards and similar apparatus must have live parts protected.

Electric Heaters.—Electric heaters of all types must have no exposed binding posts or contacts. This does not apply to the heating element.

Receptacles Near Floor.—Receptacles located within 30 ins. of the floor must be of the protected-contact type. Receptacles of a type having Edison bases and receptacles having bare contacts, when the attachment plug is removed, will not be approved.

Rule Relative to Knife Switches Is Quoted and Interpreted.

Paragraph 3 of Rule 24 of the city Electrical Code reads as follows:

"Knife switches, except on panelboards and switchboards, must be of the safety inclosed type. Safety inclosed switches must be of an approved design and arranged to be operated from the outside of the inclosure. They shall be so marked as to indicate, without opening the inclosure, whether the switch is in the 'on' or 'off' position. They shall be so constructed and installed that the fuses, if fuses are used, will be dead when the switch is in the open position, and, except in the case of double-throw and a-c. motor-starting switches, designed for 'starting' and 'running' positions, must be so constructed and installed that the blades of the switch will be dead when the switch is in the open position. If, in order to comply with the above, the incoming wires must be connected to certain terminals, such terminals must be marked 'line.'"

This rule applies to all knife switches manually operated. Automatic switches may be inclosed in standard cabinets, with hinged doors. This rule becomes effective July 1, 1920.

Strip and link fuses will not be accepted after July 1, 1920. After this date all fuses must be of the plug or cartridge type.

Where devices are placed in metal cabinets, such cabinets must comply with the specifications on cutout cabinets and boxes.

EMERGENCY METAL FILLER FOR CONDUIT-OUTLET HOLES.

By S. M. Adams.

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An effective conduit-outlet-hole filler can be improvised of sheet iron as indicated in the accompanying illustrations. Fig. 1 shows how the piece of metal, from which the filler is to

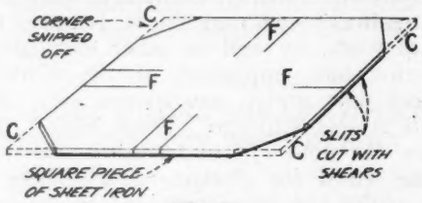


Fig. 1.

be formed, may be cut from a scrap of sheet iron and Figs. 2 and 3 depict the filler in position. These illustrations, taken together, are almost self explanatory. After the piece has been cut as shown in Fig. 1, the fingers, *F*, are bent

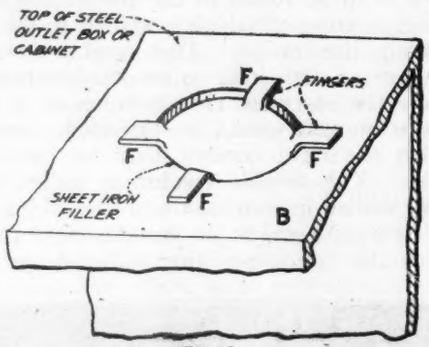


Fig. 2.

vertically upward. Then they are pushed through the outlet hole and bent down, by pounding on them with a hammer, to the position shown in Fig. 2. Outlet-hole fillers which can be regularly purchased on the market are preferable to this improvised filler and are prob-

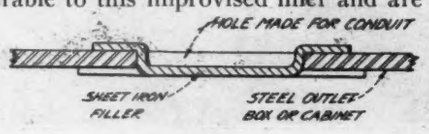


Fig. 3.

able cheaper, if the time required to make the filler is considered. However, in an emergency, when the commercial fillers are not available, those of the type illustrated will serve the purpose. Holes are often left open on account of the lack of suitable covers, but such a practice is bad as it results in allowing dirt to collect inside of the cabinet. Insects and even mice have been known to cause trouble after gaining entrance to cutout cabinets through unfilled conduit openings.

CONTRACTOR-DEALER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-keeping for the Dealer in Electrical Goods

MOTION IN WINDOW DISPLAY TELLS BETTER SALES STORY.

Appliances in Operation, or Lights That Flash, Multiply Sales Value of Displays Many Times at Very Small Cost.

There is nothing that will attract general interest and attention like motion. The dealer places an electric washing machine in his window. If that machine does not move it will attract but passing attention. If the dealer connects it with the electric circuit and sets it to working, it is immediately noticeable that those who would otherwise pass with merely a glance will stop and look.

One dealer went so far as to place a washing machine out on the sidewalk and set it in motion there. It happened that the building he occupied set back a few feet from the property line and he took advantage of the extra sidewalk space this gave him to make an outdoor display. It is needless to say that it attracted much attention.

Dealers everywhere are awake to the realization that a real sales apportunity is missed when a fan, sewing machine, washer or anything else that rnns with a motor is placed in the display window without being connected to an electric circuit and operated. The cost of the electricity used is but little, while the attention that the moving appliance attracts is multiplied many times.

When lamps form the display the same result is obtained by use of a flasher that causes them to flash off and on frequently. The flashing of the light is a good substitute and gives action to the display. Where motionless articles are distributed among or around the moving appliance in the window the very best results have been secured in the increased sale of all the articles in the display.

EASY METHOD OF ORDERING REPAIR PARTS FOR CLEANERS.

One Manufacturer Furnishes Dealers with Chart and Price List to Simplify Making of Requisition for Repairs.

One of the most convenient and simple methods for the ordering of repair parts for an electrical appliance is that furnished to dealers by the Eureka Electric Vacuum Cleaner Co., Detroit. This company is sending to the dealers two large folders containing charts which show the exact location of every part of its vacuum cleaners. Each part is numbered to key with a descriptive price list. In addition to the key number of the part, the dealer also sends in the number of the machine for which the repair is intended. In all, there are 90 parts charted and listed.

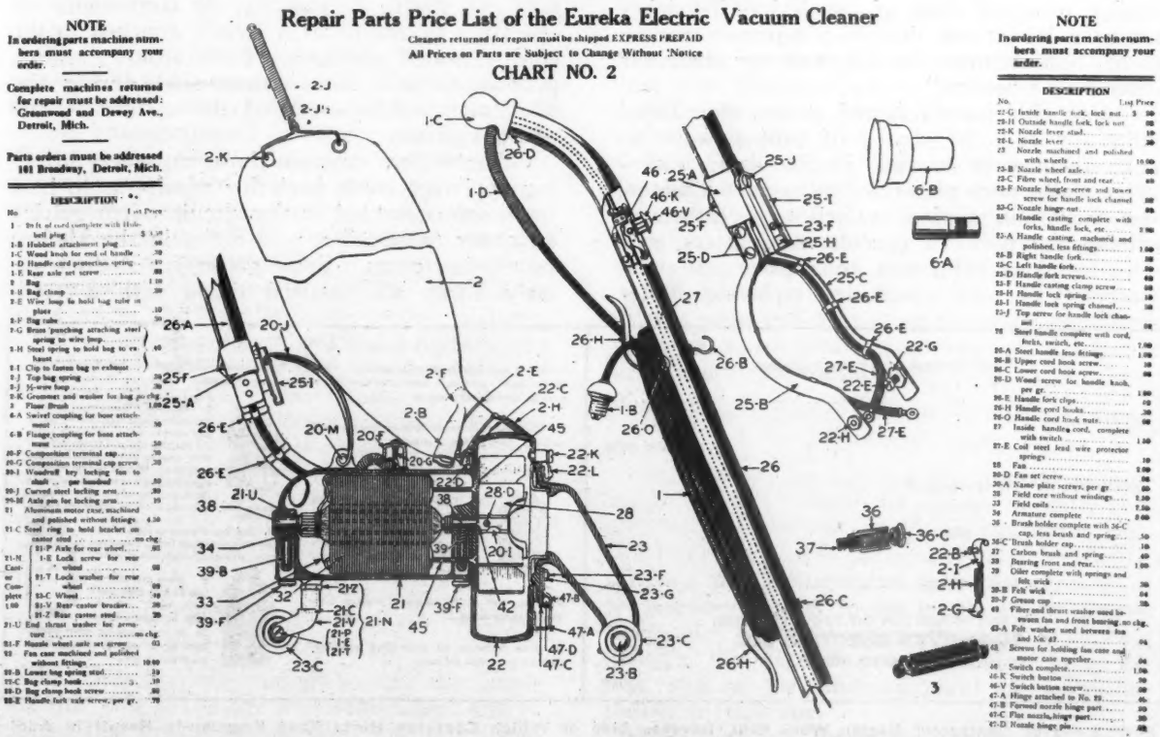

Repair Parts Price List of the Eureka Electric Vacuum Cleaner
Cleaners returned for repair must be shipped EXPRESS PREPAID
All Prices on Parts are Subject to Change Without Notice
CHART NO. 2
NOTE
In ordering parts machine numbers must accompany your order.
Complete machines returned for repair must be addressed: Greenwood and Dewey Ave., Detroit, Mich.
Parts orders must be addressed 101 Broadway, Detroit, Mich.
DESCRIPTION
NOTE
In ordering parts machine numbers must accompany your order.
DESCRIPTION

Chart and Price List for Guidance of Dealers in Ordering Repair Parts for Eureka Vacuum Cleaner.

Electrical Contractor Who Adds Extra Profits to Sales by Attention to Small Details

Small Work Slip Presented to Client by Electrician Conveys Hints Suggesting Extra Needs and the Economy of Immediate Installation

By GEORGE J. KIRKGASSER

One electrical contractor with an eye open to the profits in small details has his men carry a small number of fittings such as switches, switch plates, sockets, attachment plugs, appliance cord, feed-through switches for cords of appliances, taplets, etc., so that small repair or replacement jobs can be taken care of promptly and at a smaller cost to the customer. Every time the contractor's men get into a home they make it a point to inquire about the appliances, lamps and other electrical fittings. This inquiry often helps to bring to light an electrical appliance that is out of use because of some minor trouble.

To assist in this work a small printed slip may be used which is handed to the owner or his wife by the electrician on his arrival. One side of this slip reads as follows: "Your Mr. .....called today to attend to the work as requested." Below this is space for the signature, while at the top a line directs attention to the reverse side. As the electrician is doing his work some of the suggestions on the reverse side may remind the reader of some needs and result in extra business, while, since the electrician is there, the time of coming and going need not be charged up against the extra work. The contractor and the customer both gain.

The reverse side of one of the slips has the following message: "While our man has his material and tools with him he can make other repairs or install some of the devices listed below at a lower cost than if a separate trip be made. Check over the list, ask our man for prices—save money."

Among the items referred to are illuminated bulbs for ends of chains of pull sockets, to make them easy to find in the dark; illuminated wall switch plates and other switch plates; new flush and surface switches; feed-through switches for flatirons, percolators, toasters, etc.; bell-ringing transformers to replace batteries; baseboard or wall receptacles, replacing duplex types for single outlets; sockets for replacement.

Slips of the above kind may also be used to check up calls, and the time of going and coming may be stamped on them when leaving and returning to the shop.

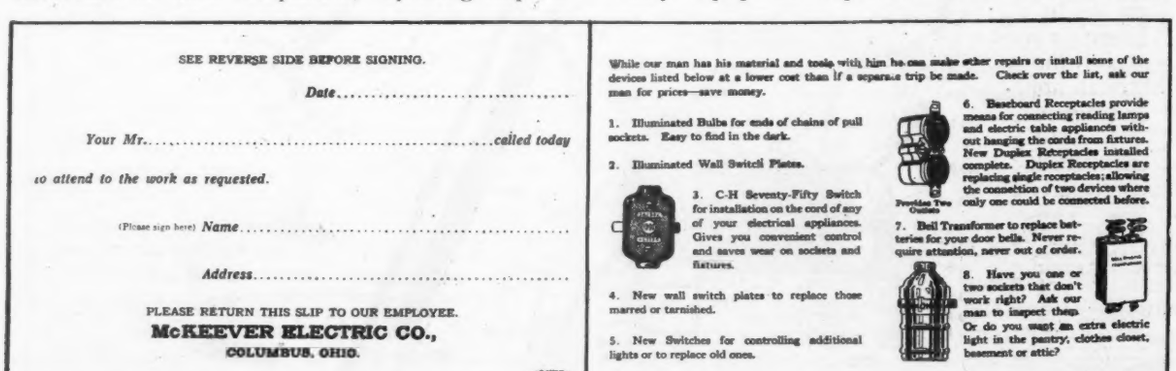
Selling Extra Outlets and Switches.

Adding extra profits to wiring jobs by going over the plans before starting the work has been mentioned in a previous article. This method is different than the so-called "extras" as often practiced, in that the subject is taken up prior to beginning and creates a better feeling than when brought up after the work is under way, although the latter may be necessary sometimes.

Where houses are put up by real estate firms and a minimum of outlets specified, the contractor can put in figures to cover these, but since many of these houses are sold before being completed the contractor may obtain the name of the persons purchasing, and, by working with the architect or building superintendent, point out the convenience of a more adequate installation. For the good of all concerned and the greater and more satisfactory use of electrical appliances this should be done whenever possible.

In the store sales plus work can be exercised every day to advantage. A Plainfield (N. J.) dealer sold 200 switches for use on electrical appliances by instructing his salesmen to play up the use of the appliances rather than just the appliance itself. In this way the convenience of operating by means of a switch attached to the cord appealed and 95% of the irons, toasters, percolators and table stoves sold during the Christmas holidays carried the additional sale of the switches.

Other dealers question those customers bringing appliance cords back for repairs as to how these are connected to the circuit, often getting an order to install a new outlet in the kitchen or another room. Some go so far as to regularly equip all repaired cords with a feed-


SEE REVERSE SIDE BEFORE SIGNING.

Date.....

Your Mr......*called today*

to attend to the work as requested.

(Please sign here) *Name*.....

Address.....

PLEASE RETURN THIS SLIP TO OUR EMPLOYEE.

McKEEVER ELECTRIC CO.,
COLUMBUS, OHIO.

(OVER)

While our man has his material and tools with him he can make other repairs or install some of the devices listed below at a lower cost than if a separate trip be made. Check over the list, ask our man for prices—save money.

1. Illuminated Bulbs for ends of chains of pull sockets. Easy to find in the dark.

2. Illuminated Wall Switch Plates.

3. C-H Seventy-Fifty Switch for installation on the cord of any of your electrical appliances. Gives you convenient control and saves wear on sockets and fixtures.

4. New wall switch plates to replace those marred or tarnished.

5. New Switches for controlling additional lights or to replace old ones.

6. Baseboard Receptacles provide means for connecting reading lamps and electric table appliances without hanging the cords from fixtures. New Duplex Receptacles installed complete. Duplex Receptacles are replacing single receptacles; allowing the connection of two devices where only one could be connected before.

Provides Two Outlets

7. Bell Transformer to replace batteries for your door bells. Never require attention, never out of order.

8. Have you one or two sockets that don't work right? Ask our man to inspect them. Or do you want an extra electric light in the pantry, clothes closet, basement or attic?

Both Sides of Contractor-Dealer Work Slip, Reverse Side of Which Contains Hints That Frequently Result in Additional Business.

through switch explaining to the customer that this will save wear on the connector plug by making it unnecessary to pull this out to break the circuit.

Selling the Work of Appliances.

All of this discussion brings out one important idea in merchandising, which is to sell what the appliance does rather than what it is. A flatiron offered as just so much metal, carries no particular appeal, but thinking and picturing what the electric flatiron accomplishes and how conveniently it does it is an entirely different proposition.

Think of receptacles not just as pieces of electrical goods but as a service to the user. To take a portable lamp and, by attaching it to a receptacle in the wall, produce light is only one step removed from real magic. The warm glow of the toaster, the rich brown, delectable toast, the result of the press of a button, is equally a feat that makes all the old East Indian tricks pale into insignificance.

Manufacturers are constantly using the magazines and newspapers to tell what electrical appliances accomplish and are thus enlarging the market—creating new customers to whom the contractor-dealer may sell. The sale of most every washing machine offers an opportunity to sell taplets, extra outlets or other fittings.

As an example from another field, take the raisin. The growers advertised hundreds of ways in which raisins could be used and, as a result, growers sell over ten times as many as they did ten years ago.

Through the publicity and sales work of another manufacturer a very wide range of applications for electric heaters, such as are used in many industrial plants for heating crane cabs, exposed rooms, drying rooms and inclosures, has opened up a field for additional wiring and sales of switches to control the heaters. Contractor-dealers who keep in touch with developments can profit by this publicity. The selling of electric soldering irons and other industrial heating appliances is good business because wiring devices, switches, etc., may be sold to give an extra profit.

The vast total of the advertising of all the manufacturers of washing machines, vacuum cleaners, lamps, heating appliances, switches, socket attachments and motors is steadily enlarging the market and making the need for more adequate outlets felt. The effects of this are just beginning to be noticed. From the van of the procession the electrical contractor and merchant has already jumped toward the top. By using every method to add extra profits by doing customers a real service, a still better financial standing is insured.

Advantage of Photographs Supplemental to Sales Efforts of Dealers in New and Old Fields

Commercial Views of Actual Installations and Operation of Electric Appliances in Local Homes Prove Successful Merchandising Feature

By FRANK H. WILLIAMS

People are interested nowadays in pictures and particularly in photographs. It is noticeable that there is nearly always someone standing in front of the photographer's showcase looking at the photos of the people on display, whether the observer knows any of them or not. Again, everyone knows how immensely popular the rotogravure sections of the newspapers are, and how people always pay a lot of attention to the illustrations in periodicals. Again, there is no doubt as to the popularity of motion pictures.

There's a reason for all this and a decided hint in it for the more successful merchandising of electrical appliances. The reason is that this is the age of visualization when folks formed the habit of wanting everything to be shown to them by the medium of pictures, and they've come to have an immense faith in pictured evidence. Thus it is that dealers are more generally using photographs to help sell their electrical appliances.

Age of Visualization Turned to Account By Dealer.

But, while it is easy enough to state the simple fact that this is the age of visualization, and to suggest that photos can be used with much success in the retail marketing of electrical appliances, the question arises in some minds as to just how this can best be done—in just what specific ways can photos be used to help sell electrical goods?

In a Southern city there is a dealer in electrical appliances who decided to use photographs as an aid in selling. He came to this determination because he was a newcomer in this field, because he had extremely keen competition and because he felt that he must do something a trifle different from the other merchants if he was to establish himself quickly and secure his share of the business.

Using Photographs of Actual Installations To Convince Trade.

Accordingly, he hired a commercial photographer to take pictures of a home recently constructed by a friend of his in which the electrical equipment was particularly comprehensive. He had the photographer take photographs of the vacuum cleaner in the home, of the electric range, the electric heaters, the electric cooking utensils, the electric sewing machine, in operation, and all the other electrical appliances installed in the home.

After securing these photographs the dealer neatly typed a caption for each of them and

pasted the captions on the bottom of the photographs. Then he neatly arranged the pictures on a large placard, and over them painted the following inscription:

How many of these electrical labor savers and time savers are there in your home?

These pictures were taken in a recently erected local home. This house has been completely equipped electrically by us.

Look at all the appliances shown in these photographs. Read the captions. Read what the appliances are, how and where they are installed, and what they will do for this household in the way of saving time and labor. Then come in and let us tell you how electrical appliances will make housework easier in your home.

We have some other interesting local photos inside which we'll be glad to show you.

The placard attracted and held the attention of many persons, and as the story told by the pictures was so pointed and convincing the display resulted in a rush of business.

The dealer later had his commercial photographer take pictures of other installations made by his store in office buildings and plants as well as in homes. This collection showed just how certain companies were using vacuum cleaners to advantage in their business, how office buildings were making use of electrical appliances purchased from him, and how other establishments were using electrical goods with telling effect.

Use of photographs in this way by the dealer gave an entirely novel angle to his merchandising methods and this angle was of a sort that make the people take notice and be more inclined to purchase goods than if the dealer had relied entirely upon word-of-mouth to convince them of the merit of his goods?

Cost of Photographs Not Excessive.

Any dealer who has ever used commercial photographs knows that the cost is generally much cheaper than he had at first figured. Commercial photographers are, as a rule, good at getting the sort of pictures the dealer wants. That's their business, and the better they are at it the more business they secure. This dealer did not worry on the score of securing the proper sort of photographs.

But while this dealer at first doubted the use of photographs in selling electrical goods effectively in the case of a new store, there was no doubt of their value when his store became established with a large and growing trade.

It was not so very long before people began coming into the establishment and it was rather difficult at times for the salespeople to wait on all the customers with the speed they'd like to bring to the task. Then it was that the proprietor provided an album containing pictures of installations in local homes and factories, and of interesting photographs showing the way to use various of the appliances on sale at the store. Each carried a caption telling just exactly what the appliance was, how it was used and how many of the appliances had been sold in the city. This album proved of great interest to all waiting customers, and the local touch given by telling the number of appliances sold in the city added to the force of the photographs—a silent salesman for the appliances until such time as the salesman could give the waiting customer his full attention.

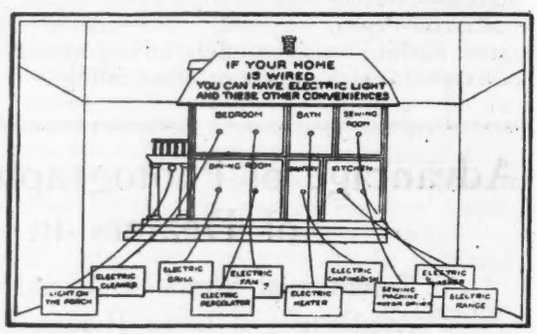
WINDOW DISPLAY AS AID TO HOME-WIRING CAMPAIGN.

Tapes Leading from Rooms of House Plan to Cards and Appliances in the Foreground Help Produce an Effective Appeal.

During this summer many contractor-dealers are prepared to give more than usual attention to house wiring. In the past it has been considered rather difficult to arrange an effective display for house wiring in the show window. Recently, however, a number of dealers' windows have been showing some creditable ideas along this line.

One particularly effective house-wiring display now being utilized by contractor-dealers in different parts of the country is here illustrated as it appeared in a recent bulletin of the Society for Electrical Development.

For the backing of the display there is used an enlarged architectural plan of a residence, the side elevation being drawn on beaverboard and each room plainly designated in black letters. In the foreground of the display are arranged a number of electrical appliances, including vacuum cleaner, sewing machine, electric washer, flatiron and a number of table appliances.



Design for Window House-Wiring Display.

Above the house plan a large card announces that "If your house is wired for electricity, you can use these time and labor-saving household conveniences." From each room designated on the plan a tape or ribbon leads to one or more of the appliances in the foreground. In this manner the display of the appliances helps to sell the wiring, while the idea helps to sell more appliances to those who have their homes already wired.

NEW ELECTRICAL STORE TO BE OPENED AT MINNEAPOLIS.

The Progressive Electric Co. has been organized at Minneapolis, Minn., with M. V. Rutherford, formerly sales manager of the Sterling Electric Co., of that city, as president. The company is preparing plans for a modern electric shop, to be established in the downtown shopping district. Mr. Rutherford displayed, during his 15 years' association with the Sterling Electric Co., many advanced ideas on the subject of electrical retailing, and will incorporate many of them in the new store, which promises to be one of the best equipped in the Twin Cities.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 492.—Load-Factor on Distribution Transformers.—What is the customary ratio of maximum load to average load carried on distribution transformers serving purely residence neighborhoods when but few appliances are in use? What is the ratio when a considerable number of appliances are fairly well distributed among the customers? What is the ratio of total kw-hr. output of such transformers to their total kw-hr. capacity when working at their maximum demand? What transformer capacity should be installed per kw. of total connected load for purely lighting load and for a load involving the use of appliances as well as lighting?—R. H. C., Woodland, Ill.

No. 494.—Operating 60-Cycle Motor of 50 Cycles.—I have a 220-volt, 1200-r.p.m., 60-cycle induction motor which I want to install on a circuit operating at 220 volts and 50 cycles. The machine is in good order and is free from grounds, having been tested out with a pressure of 750 volts between winding and core. It operates without any unusual sound and without heating at no load, but I am not certain just what would take place if the machine was put under load, which will be about 7.5 hp. for a period of 10 hrs. per day. Should the motor be rewound or will it operate safely at 7.5 hp.?—H. F. W., Logansport, Ind.

No. 495.—Synchronous Motor as a Condenser.—Will someone please explain for me just how it is that a synchronous motor acts like a condenser? I have read any number of articles on the use of motors as condensers, but have never had a clear explanation given as to how such an effect is produced.—R. H. N., Peoria, Ill.

No. 496.—Meter for Rectified Current.—What kind or type of ammeter should be used to measure accurately the current delivered on the d-c. side of a mercury-arc rectifier?—H. R. C., Houston, Texas.

Answers.

No. 491.—Paralleling Belted Exciters.—Considerable difficulty is experienced in paralleling the exciters in the plant where I operate. There are two 150-kw. alternators direct-connected to Corliss engines in this plant. There is a 20-kw. exciter belted to each engine. These exciters carry a small amount of d-c. load during the day aside from serving as exciters. Our practice in paralleling is as follows: With one machine running and connected to the system, the second machine is brought up to proper speed as indicated by the synchronizing lamps. The incoming exciter is then brought up to voltage a little above the exciter-bus voltage and then connected. The second alternator is brought up to proper voltage a little above the main bus and cut into service. In the period just before connecting in the second alternator, the two exciters sometimes give trouble. They will shift the load from one to the other, sometimes slowly and sometimes quite rapidly. Will someone tell me what the cause of this is and how this condition can be overcome? These alternators have to be paralleled every day and the exciter trouble is quite annoying.—J. C. B., Cincinnati.

Answer.—In studying the troubles experienced by J. C. B. in paralleling exciters belted to direct-connected alternators, a number of possible causes of such trouble suggest themselves. In the first place it is evident that the trouble is not inherent in the exciters themselves, since the trouble is experienced only during the starting period. Trouble with either exciter would undoubtedly develop when running alone if it was defective in design or construction.

One possible source of trouble might be in the d-c. load carried at locations outside the engine room. However, this is probably not the cause, since any trouble from this source would be experienced at other times as well as during the paralleling period. The probable source of the disturbances noted is incorrect operating practice. According to the procedure given, the exciters, which are belted to the main units, are paralleled before the main units are connected together. Under such conditions, one engine is undoubtedly carrying some load while the other is running idle with a very short cut-off and, consequently, subject to considerable speed variations with slight variations in the position of the main value. Variations in the load on the working machine will cause slight speed variations during the time that the governor is operating to set the cut-off position to the new conditions. Only the paralleled exciters are functioning to hold the two engines to the same speeds during the short intervals while the governors restore normal conditions. Under such circumstances, it can be readily seen that the exciters are liable to be motorized one at a time and that quite large interchanges of power may be made in comparison to the exciter capacity. The engines and generators have a large amount of stored energy in their rotating parts and small speed variations may require heavy overload outputs on the part of the exciters.

The proper operating practice would be to bring the incoming machine up to speed and parallel the alternators, taking the excitation for both machines from the exciter belted to the working unit. After the alternators are in parallel the second exciter may be connected to the d-c. bus without the present difficulty. The exciters should be plenty large enough for this procedure.—F. H. C., Chicago.

No. 490.—Lubrication of Slip Rings.—In the substation where I work there is a considerable amount of trouble experienced in preventing the copper-leaf brushes from cutting the collector rings on the a-c. side of the rotary converters. Will some one give me a formula for a good lubricant or the name of a prepared oil that will overcome this trouble?—J. A. R., Boston, Mass.

Answer.—The application of a lubricant to a commutator or slip-ring often improves conditions considerably, but if the cutting is severe the seat of the trouble must be located and corrected before the lubricating medium can be of any real value. Should rings be badly scored they should be trued up and the brushes carefully trimmed. Oftentimes cutting may be remedied by the readjustment of the brushes themselves.

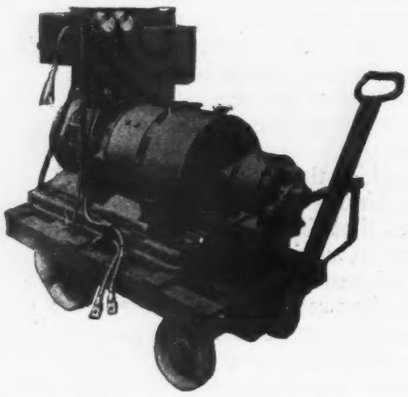
Vaseline sparingly applied to the rings with a bit of canvas or a stick, serves very well as a lubrication. There are on the market several compounds and lubricants for this purpose, all of which are to be found at the supply houses. It should be borne in mind that the excessive use of these lubricating mediums is detrimental and that they should be used only occasionally.—W. F. P., Atlantic, Mass.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Electric Welding Outfit for One-Man Operation.

High efficiency is claimed for the electric welding outfit shown in the accompanying illustration because of the fact that the generator operates at arc voltage. The generator is designed to inherently stabilize the arc, thereby eliminating the use of relays and other auxiliary equipment, which increase the



Portable Welding Outfit.

costs of the outfit, but are not quick enough in operation to follow the changes of the arc circuit.

This outfit, which is made by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is provided with a generator rated at 175 amperes. The generator has commutating poles and an exceptionally long commutator which enables it to carry the momentary overload at the instant of striking the arc without special overload protection. It is mounted on a common shaft and bedplate with the motor. A pedestal bearing is supplied at the commutator end; the bearing carries a bracket for supporting the exciter which also is coupled to the common shaft of the set. Motors can be supplied for either d-c. or a-c. circuits. Where an a-c. motor is used, leads are brought outside the motor frame for connecting to either 220- or 440-volt circuits. This feature is particularly desirable on portable outfits which may be moved from one shop to another having supply circuits of different voltages.

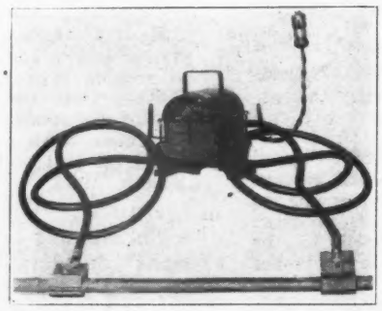
The control for the single-operator equipment consists of a small ebony asbestos panel, mounted upon angle-iron framework. The field rheostat for regulating the welding current, voltmeter, ammeter and two-pole knife switch are mounted upon the panel. The design of the control is such that very close adjustment of current may be easily and quickly made, and, once made, the amount of current at the weld will remain fixed within close limits until changed by the operator. There are 21 steps provided for the adjustment of current from 50 to 225 amperes. This gives a current regulation of less than 9 amperes per step, which makes it much easier for a welder to do vertical or overhead work often encountered in railroad shops and ship construction.

Where the equipment is required for portable service, the motor-generator set with the control panel is mounted on a fabricated steel truck, equipped with roller-bearing wheels, and can be hauled about the shop or yards by one man. The suitable plugs and receptacles for three-phase, three-wire or two-phase four-wire, a-c. motors allow the set to be quickly and conveniently connected to the supply circuit at any desirable point. Only one plug is required for the motor, but the number of receptacles required depends upon the number of points at which it is desired to do welding work. These plugs and receptacles are supplied on special orders.

Other machines of larger size and for the service of several welders are included in a set of welding-machine designs in the same class with this single-operator outfit. These machines are built in capacities up to 1000 amperes.

Portable Pipe-Thawing Outfit.

Water pipes are frequently frozen in unheated basements, under porches or inside the house during extremely cold weather. It is an annoying task to thaw these pipes with hot water and it is also quite dangerous to do the thawing with a blow-torch or with fire. A convenient portable transformer outfit, made by the General Electric Co., Schenectady, N. Y., and intended for thawing service, is shown in the accompanying illustration. As may be noted the outfit is provided with suitable cables and



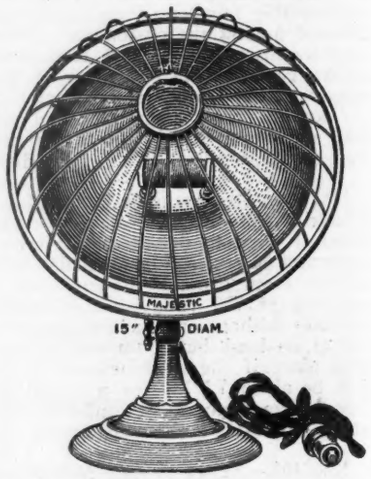
Pipe-Thawing Transformer and Attachments.

clamps and is connected for service to an ordinary socket.

This equipment, which is called the "Wayne Pipe Thawer," consumes from 500 to 650 watts or about as much energy as an ordinary flatiron. Circuits of from 100 to 125 volts at 50 to 60 cycles are suitable for the attachment and satisfactory operation of the thawer. The entire outfit including a 10-ft. primary connection, two 7.5-ft. secondary cables with clamps, transformer and attachment plug, weighs only 35 lbs. and has a maximum dimension of 10.5 ins.

New Type of Portable Electric Heater.

There are often days or parts of days during the between seasons of the year when a little heat is required to warm a room in the home or a small space in an office. Electric heaters are more convenient and economical



Heater With Burnished Copper Parabolic Reflector.

than any other type of equipment for this kind of service. They can be moved from room to room and attached to an ordinary lamp socket or, better still, to a base-board outlet where one is available.

A heater of this convenient type, shown in the accompanying illustration, has recently been put on the market by the Majestic Electric Development Co., San Francisco, Cal. This new heater, which is known as Majestic No. 11, is 19.25 ins. high, weighs 7.5 lbs. and uses 615 watts Pure burnished copper is used in the construction of the reflector, which is parabolic in shape and is inclosed in an outside shell 14.5 ins. in diameter. A dead-air space is left between the reflector and the steel back to insure the safe and cool handling of the appliance, and a wire guard covers the front for protection from the hot live heating element. Other styles of heaters made by the same manufacturer include grate type, log-type, and portable stove-type heaters.

Wire Guard for Reflector Lamp.

Guards protecting lamps in exposed locations serve the double purpose of preventing theft and mechanical injury. Frank W. Morse, Boston, Mass., is now manufacturing a lamp guard for attachment to steel reflectors. This guard is made by the electric-welding process and is attached to the reflector by a screw-eye bolt which is locked and unlocked by a special key.

LATEST APPROVED APPLIANCES

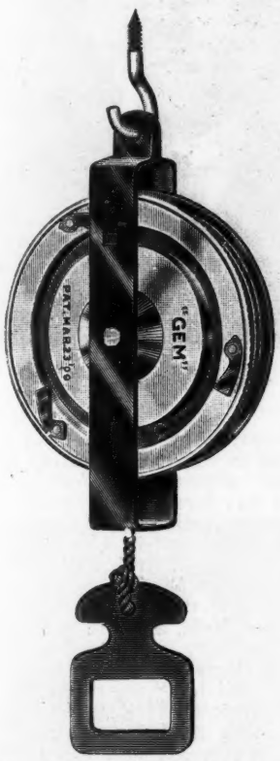
Approved by Underwriters' Laboratories, Following Examination and Tests Conducted Under the Standards of the National Electrical Code

Conduit Outlet Bushings and Fittings.—Electrical Fittings & Foundry, Ltd., 331 King street, West, Toronto, Ont. Listed May 4, 1920.

"Diamond B." Drawn-steel or cast-iron locknuts and bushings 4 ins. or less.

Lamp Adjusters.—E. R. Frost, 2744 Pine Grove avenue, Chicago. Listed May 11, 1920.

"Gem." Consisting of spring-controlled, steel pulley mounted in iron



"Gem" Lamp Cord Adjuster.

bracket; cord is looped around fiber insulator which is attached by string to pulley; designed for adjustment of pendent lamps.

Fixture Fittings.—Electrical Fittings & Foundry, Ltd., 133 King street, West, Toronto, Ont. Listed May 4, 1920.

"Diamond B." Cast-iron crowfeet and fixture studs ½ in. or less.

Insulating Supports.—Hubbard & Co., Pittsburgh, Pa. Listed May 11, 1920.

Samped or rolled steel bases or malleable iron hooks, galvanized, to which petticoated porcelain insulators are secured; catalog Nos. 183, 190, 191, 191-A, 250, 258, 286, 296, 299, 350, 358, 383, 386, 394, 396, 450, 540, 583, 2925; insulators only, catalog Nos. 355, 1601 and 1602.

Panelboards.—Ajax Electric Co., 56 Baldwin avenue, Jersey City, N. J.

Panelboards consisting of assembly of bus bars with or without standard cutout parts, or with or without standard switches mounted on isolating bases; designed for use on low-potential circuits.

Listed March 12, 1920.

Switches Inclosed. — Wadsworth Electric Mfg. Co., Covington, Ky. Listed April 23, 1920.

Standard double-pole combination plug fuse cutout base inclosed in metal case and provided with handle for manual operation without opening case.

Switches, Inclosed.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Listed May 11, 1920.

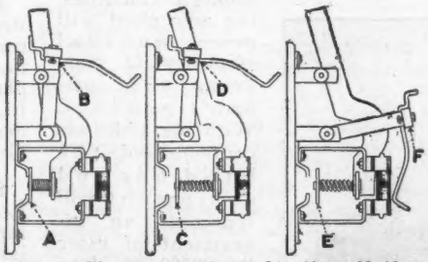
"Krantz" Type WK 100; 10 hp., 250 volts; 15 hp., 440 and 550 volts; two and three-pole quick-make-and-break motor-starting switch equipped with either of two types of time-element cartridges designed to afford protection to motor against overloads maintained for longer than predetermined periods by opening circuit to no-voltage release coil, or by opening supply circuit. Inclosed in metal case and designed for manual operation without opening case.

Switches, Knife.—Trumbull Electric Mfg. Co., Plainville, Conn. Listed May 7, 1920.

"Circle T." 1500, 2000, 2400, 2800 amperes, 25 cycles; 1500, 1900, 2300, 2700 amperes, 60 cycles, 250 volts a-c; type A.

Switches, Inclosed. — Frank Adam Electric Co., 3650 Windsor street, St. Louis, Mo.

Three-pole, motor-starting knife switches with clips for standard cartridge inclosed fuses which are short-circuited when switch is in starting position; inclosed in metal case and designed for manual operation without opening the case; fuse terminals



Adam Three-pole Motor-Starting Knife Switch.

are dead at all times while they are exposed for inspection or replacements; 7.5 hp., 250 volts.

Listed March 30, 1920.

Switches, Push Flush. — Chelten Electric Co., 4859 Stenton avenue, Philadelphia.

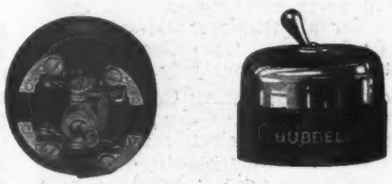
Four-way push flush switches; catalog No. 4003.

Listed April 12, 1920.

Switches, Surface. — The Bryant Electric Co., Bridgeport, Conn. Listed April 27, 1920.

"Bryant" and "Perkins" series multiple; 20 amperes, 250 volts; 40 amperes, 125 volts; catalog Nos. 2571, 2621, 2622, 2675, 2676, 2677.

Switches, Surface. — Harvey Hubbell, Bridgeport, Conn.



Hubbell Double Pole Surface Switch.

"Hubbell" double-pole surface switches; catalog No. 8102.

Listed March 26, 1920.

Switches, Push and Rotary Flush.—The Bryant Electric Co., Bridgeport, Conn.

Single-pole, catalog Nos. 601, 605, 2093-94, 2201, 2205-06, 2295, 2340-41, 2346-47, 2457, 2491, 2522, 2525; with receptacles, 2519, 2641, 2643, 2701, 2901, 2901-H and 2707-08. Switches 1-8 gang, for use only in steel walls of Pullman cars which contain no combustible material; 5 amperes, 75 volts; without sheet-steel supporting frame, catalog No. 40; with frame, catalog Nos. 41-48 inclusive. Double-pole, catalog Nos. 602, 606, 609-10, 2095, 2202, 2207, 2298, 2344, 2350, 2462, 2494, 2523, 2526; with receptacle, 2520, 2568; with plate 2569, 2623-24. Duplex Switches, combination of two single-pole, catalog No. 2709; combination of one single-pole and one 3-way, catalog No. 2710; combination of one single-pole and one 2-circuit electrolier, catalog Nos. 2639 and 2640. Momentary contact, 10 amperes, 250 volts, catalog No. 2202-Y.

Listed April 12, 1920.

Wires, Portable, Flexible Cord for Heaters.—Standard Underground Cable Co. of Canada, Hamilton, Ont. Listed May 11, 1920.

Marking: Two brown threads cabled with copper strands. Tag on coil to read "National Electrical Code Standard."

Wires, Slow-Burning Weatherproof. —Illinois Wire & Cable Co., Sycamore, Ill.

Marking: Green and brown thread crossing in middle braid.

Listed April 2, 1920.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Advance Electric Co., 6315 Maple avenue, St. Louis, Mo., will build a one-story plant, 50 by 100 ft., to cost about $15,000. E. Bretch is the president of the company.

Philadelphia Insulated Wire Co., Philadelphia, Pa., has purchased the entire business of the Alfred F. Moore Estate, situated at the corner of Third and Race streets, Philadelphia, and advises the trade that the business will be continued under the same management as heretofore.

Hopewell Insulation & Manufacturing Co., Inc., Hopewell, Va., is planning to manufacture hard rubber, composition and condensation molded insulated parts, and high-tension insulators for all wireless and transmission purposes. Operation of the plant will start about July 15.

Hergi Manufacturing Co., 75 Third street, Bridgeport, Conn., manufacturer of portable electric machinery, has issued bulletins No. 10, on grinding wheels and points; No. 11, on die sinking outfit; No. 12, on scraping outfit; No. 13, on screw driving outfit and No. 14 on hammers and grinders.

General Electric Company, Schenectady, N. Y., has acquired a tract of land aggregating about 20 acres on Elmwood avenue, between 68th and 70th streets, Philadelphia, Pa., for a consideration said to be $275,000. The property will be used as a site for a new plant, and plans are under way, it is said, for the initial units. It is proposed to inaugurate construction work in the fall. The entire plant with equipment is estimated to cost close to $5,000,000.

United States Electric Co., New London, Conn., has awarded a contract to Arthur T. Jackson & Co., 108 State street, for the erection of a one-story addition to its plant at Fort Trumbull, about 75 by 100 ft. Improvements will be made also in a number of buildings at the works, and the entire plant arranged for the manufacture of electrical riveting and heating apparatus. The work is estimated to cost about $50,000.

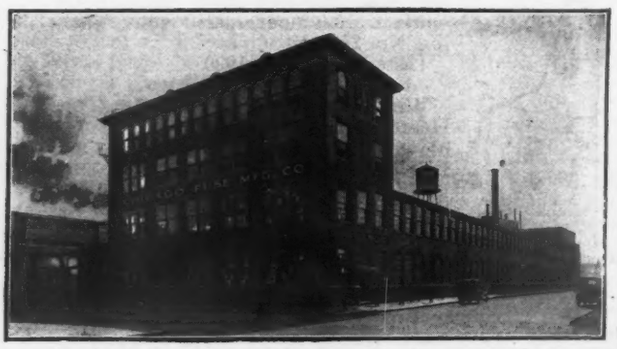
Federal Battery Service, Inc., operating a plant at 1525 Seventh street N. W., Washington, D. C., for the manufacture of batteries, etc., is planning for extensions to increase its operations, including the establishment of numerous stations in various large cities.

Roberts-Hamilton Co., 413 South Fourth street, Minneapolis, Minn., manufacturer of electric lighting plants and electrical supplies, has issued catalog No. 42, dealing with farm-lighting plants, in which a full description, with illustrations, is given of the products manufactured by the company.

Standard Battery Manufacturing Co., 1103 North Main street, Fort Worth, Tex., manufacturer of electric batteries, is planning the erection of an addition to its present plant to more than double its output. Considerable new machine shop equipment, woodworking machinery, motors, etc., will be installed. Albert Kramer is the president of the company.

Anderson Electric & Equipment Co., 154 Whiting street, Chicago, in catalog No. 3, recently issued, describes the list of specialties manufactured by the company consisting of automotive accessories, electric lighting devices, dental and laboratory devices and special manufacturing to the requirements of the customer.

Chicago Fuse Manufacturing Co. is now occupying its new factory building, Laflin and 15th streets, Chicago, where the company has 125,000 sq. ft. of floor space in a modern 2-story factory structure with a 4-story office addition, the site covering a frontage of 140 ft. on Laflin street and 360 ft. on 15th street. William W. Merrill, vice-president and treasurer of the company states that the building, which was formerly used by the Otis Elevator Co., has been entirely remodeled in accordance with the latest ideas in industrial engineering practice and the most modern equipment installed, and that in addition to providing larger and more modern facilities, the new plant will permit unusual efficiency in marketing the company's product. With the additions contemplated, the buildings and equipment will represent an investment of more than $500,000. The company's product is distributed not only in all parts of the United States, but in foreign countries as well.



New Factory Recently Occupied by the Chicago Fuse Manufacturing Co.

Edison Storage Battery Co., Orange, N. J., announces the recent appointment of Don. C. Wilson as assistant sales manager in charge of its

Don C. Wilson.

railroad department. Mr. Wilson has been active in railroad operating and mechanical departments for many years and was formerly electrical engineer for the Union Pacific railroad at Omaha, Neb., and in a similar capacity with the Central Railroad of Georgia at Savannah, Ga. Mr. Wilson was educated in the public schools of Broken Bow, Neb., and the Nebraska State University, completing his course in electrical engineering in 1907, after which he was engaged in electrical work in various capacities with the Stone & Webster Construction Co., Seattle, Wash.; the Pacific Gas & Electric Co., Los Angeles, Cal., and the Independent Telephone Co., Omaha, Neb. His office will be room 409, 23 West 43rd street, New York City.

Bryant Electric Co., State street, Bridgeport, Conn., has awarded contracts in connection with the construction of a four-story and basement plant, about 60 by 158 ft., and 60 by 60 ft., to be located on Organ street. The new works are estimated to cost about $140,000.

Stearns Motor Manufacturing Co., Ludington, Mich., manufacturer of farm-lighting and power plants, has issued a catalog setting forth the company's claims for its product. The company is at present arranging for an agency for the sale of its plants in India and has also established agencies in other parts of the world as well as in all parts of the United States.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

PROF. O. H. LELAND, of the college of civil engineering at Cornell University, has accepted a position with the J. G. White Engineering Corp., New York City.

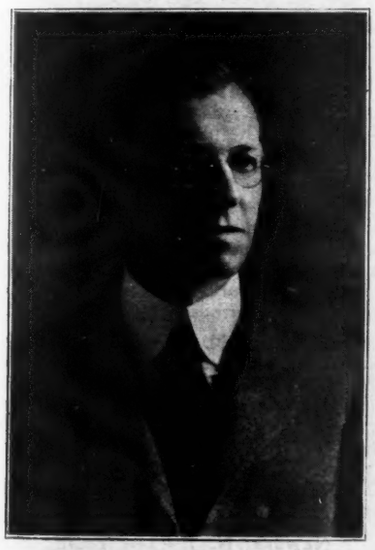
LIEUT.-COL. THOMAS F. BROWN, formerly of the ordnance department, U. S. A., has been elected president of the Colonial Brass & Bronze Co., Middleboro, Mass.

F. R. BOLLES has been appointed vice-president and general manager of the American Automatic Connector Co., Cleveland, O. Mr. Bolles was formerly vice-president and general manager of the Copper Range Railroad Co., Houghton, Mich.

CHARLES JOHNS has been appointed manager of the St. Thomas (Ont.) street railway system.

R. K. TIFFANY, project manager of the United States Reclamation Service, has resigned to open an office as consulting engineer at Spokane, Wash.

D. T. LAYLIN has recently been appointed sales manager of the Adams-Bagnall Electric Co., Cleveland, manufacturers of "ABolite" reflectors, small motors and gyrofans. Mr. Laylin has been associated with the electrical business for the past 15 years. In 1905 he entered the service of the Western Electric Co. and for six years was actively interested with power apparatus sales in Chicago and New York. Following



D. T. Laylin.

five years in charge of the electrical sales and shop departments of the Strong-Carlisle-Hammond Co., Cleveland, Mr. Laylin became electrical engineer of the Standard Parts Co., manufacturers of automobile parts, with headquarters in Cleveland. Mr. Laylin is a graduate of Ohio State University.

S. H. CLELAND has been appointed eastern sales manager of the National Engineering Co., Chicago. He has opened temporary offices at 15 East 40th street, New York City.

LOUISE B. KRAUSE, librarian of H. M. Byllesby & Co., Chicago, was elected second vice-president of the American Library Association at its annual meeting in Colorado Springs, Colo., June 7.

T. W. MCMANUS, for the past six years master mechanic for the Kellogg Switchboard & Supply Co., Chicago, has been elected vice-president and general manager of the Security Tool Works, Chicago, and is now at work in his new position.

CHARLES F. KETTERING, president of the Delco Light Co., Dayton, O., was elected president of the Engineering Club of Dayton at the recent annual election. Mr. Kettering is a fellow of the American Institute of Electrical Engineers.

EDWARD BLAKENY, for many years in the engineering departments of the American Telephone & Telegraph Co., and the Western Union Telegraph Co., is now a member of the technical staff of the research department of the Radio Corp. of America, New York City.

WILLARD L. CASE has been elected treasurer of the Yale & Towne Manufacturing Co., Stamford, Conn., succeeding John B. Milliken, who recently resigned. Mr. Case's long experience has involved relations with power and light companies, foundries and machine shops.

W. H. MCINTYRE, formerly general manager of the Ottawa (Ont.) Electric & Gas Co., was presented with a gold watch and chain by the employes of that company on the occasion of his leaving the electrical field to take up the position of general manager of the Ottawa Car Co., Ottawa, Ont.

GEORGE M. WISNER, for the past 13 years chief engineer of the sanitary district of Chicago, has resigned to enter business for himself. Mr. Wisner has been connected with the sanitary district work for 28 years and will continue to act as consulting engineer for the district board.

ROBERT MONTGOMERY, who has been manager of the commercial department of the Louisville (Ky.) Gas & Electric Co. for the past seven years, has been appointed manager of the investment department of the company. As manager of the commercial department, Mr. Montgomery made a very successful record, particularly in the wiring for electric service of already built houses, securing large additions to the industrial power business of the company, and in promoting the increased use of electrical appliances.

Obituary.

CHARLES BLIZARD, third vice-president of the Electric Storage Battery Co., Philadelphia, Pa., and one of the best known men in the manufac-

Charles Blizard.

turing end of the electrical industry, died at Philadelphia on June 12. Although born at Stevens Point, Wis., 56 years ago, Mr. Blizard was educated in the east, graduating from the Brooklyn Polytechnic Institute. In October, 1893, he became associated with the Electric Storage Battery Co. as manager of the New York City office and in 1900 was moved to the Philadelphia office and placed in charge of the sales department. In April, 1906, he was made third vice-president, which position he retained until the time of his death. Mr. Blizard was always a prominent figure at electrical conventions and served on the exhibition committee of the National Electric Light Association for many years. In the days of the Electric Vehicle Association he was an active figure in the organization, serving on many committees, and later continued his activities in the electric vehicle section of the N. E. L. A. He was a member of the board of governors and chairman of the finance committee of the Associated Manufacturers of Electrical Supplies and was his company's official representative in the Motor Accessory Manufacturers Association. Mr. Blizard was a member of the American Institute of Electrical Engineers, the Engineers' Club of New York City, the Germantown Cricket Club and the Whitemarsh Country Club.

DANIEL SKELTON, general manager of the Western Union Telegraph Co., died at his summer home, Asbury Park, N. J., from heart disease, June 16. He was 58 years of age.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Poultney, Vt. — The Ruggles Machine Co. will erect a factory building.

Dorchester, Mass. — The American Radiator Co. will build a two-story, 241 by 331 ft., warehouse.

Montague, Mass.—Plans are being prepared for the erection of a machine shop for the Montague Machine Co., at an estimated cost of $100,000.

Northampton, Mass.—The International Silver Co., Meriden, Conn., has let the contract for a one-story, 42 by 106 ft. forge shop at its branch plant in Northampton.

Springfield, Mass. — The United Electric Co. has awarded a contract for a substation to cost $100,000.

Springfield, Mass.—A contract has been let to the Walsh Boiler & Iron Works for the installation of new boiler equipment at the plant in the Technical High school.

Springfield, Mass.—The Bausch Machine Tool Co. will erect a three-story, 60 by 136 ft., plant.

Pawtucket, R. I.—Considerable electrical and mechanical equipment will be installed by the Jencks Spinning Co., 335 Barton street, at its four-story and basement mill on Weeden street, about 100 by 128 ft., with two-story extension, 80 by 173 ft., and estimated to cost about $300,000.

Waterbury, Conn.—The Waterbury Clock Co. has arranged for the erection of a one-story power house at its plant, 50 by 57 ft., to cost about $12,000.

Ausable Forks, N. Y.—The Ausable Forks Electric Co. is planning for the erection of a new power plant at Jay, N. Y., where a local franchise has been granted. Application for permission has been made to the State Public Service Commission.

Brooklyn, N. Y.—A power plant for factory service will be erected by the General Laundries, Inc., in connection with its plant on Myrtle avenue, near Marcy avenue.

Brooklyn, N. Y.—The Kings County Lighting Co., 4802 North Utrecht avenue, has been ordered by the State Public Service Commission to purchase new equipment at estimated cost of $2,000,000 for extensions and betterments in its system.

Buffalo, N. Y.—In connection with the proposed electrification of local railroad terminals, City Commissioner Perkins is urging the adoption of an ordinance covering the use of electric locomotives, operated under the storage battery system, by the different lines. It is held that this will eliminate the necessity of electrifying all the switch and yard tracks.

Flushing, L. I., N. Y.—The Hunter Illuminated Car Sign Co., Linden avenue, has filed plans for the erection of a one-story addition to its works.

Johnson City, N. Y.—The waterworks department has arranged for the installation of three 600-hp. electrically driven pumps at the local plant. Service will be furnished by the Binghamton Light, Heat & Power Co. The company has also completed arrangements for furnishing light and power at the factories of the Endicott-Johnson Corp., manufacturer of shoes.

New York, N. Y.—Goethals, Wells & Co. has been organized by officials of George W. Goethals & Co., 40 Wall street, to handle different phases of engineering and construction work not regularly executed by the parent corporation. Gen. George W. Goethals is president and George M. Wells is vice-president of the new organization.

New York, N. Y.—The New York Telephone Co. has filed plans for the erection of a one-story addition to its telephone exchange plant at Webster avenue and 178th street, 48 by 100 ft., to cost about $66,000. Plans have been prepared for extensions and improvements in the present exchange buildings at 92 Broad streets, and at Franklin and Worth streets.

New York, N. Y.—Since the first of the year, the New York Telephone Co. has installed a total of over 35,400 telephones in Greater New York, or almost as many telephones as are operated at Jersey City, Hoboken and Bayonne, N. J., combined. The company is said to have applications on hand for more than 64,850 telephones in the Greater New York district.

New York, N. Y.—The Fletcher Co. will install a power plant at its brick and concrete factory and warehouse on Varick street, near Grand street. John C. Williams, Inc., 233 Broadway, has the contract for the work.

Olean, N. Y.—The board of education will install a boiler plant in the high school to cost about $50,000. A. W. E. Schoenberg, First National Bank building, is the architect on the project.

Potsdam, N. Y.—The St. Lawrence Transmission Co. has added to its petition to the state public service commission requesting permission for erection of an addition to its power plant at Fowler, asking for authority to construct a new power plant at Russell, St. Lawrence county.

Whitehall, N. Y.—The Consolidated Light & Power Co. has made application to the state public service commission for permission to build a power plant. It is proposed to build a distributing system to furnish service to Hamton and Fort Ann. A franchise has been granted by the municipal authorities.

Butler, N. J.—The State Board of Public Utility Commissioners has approved plans submitted by the borough council for the erection of an addition to the municipal electric power plant, with the installation of new equipment for increased capacity. The plant also furnishes service to Bloomingdale.

Dover, N. J. — The New Jersey Power & Light Co. has commenced the construction of a power line from its Dover station to Dover, for increased local service. A new coal bunker has been completed at the plant, and plans have been perfected for the immediate installation of a coal-conveyor system. The company has arranged to handle the load at the plant of the Richardson & Boynton Co., Dover, manufacturer of stoves, and lines have been extended to this point. A number of motors will be installed at the stove works.

Hammonton, N. J. — The common council has granted a five-year contract to the Hammonton Telephone & Telegraph Co. for operation of an electric fire and police signal system.

Jersey City, N. J.—The American Butterine Co., 1 Montgomery street, will install a boiler plant in connection with its four-story factory, 50 by 100 ft., to be erected at Eighth and Henderson streets.

Lakehurst, N. J. — The Bureau of Yards & Docks, Washington, D. C., is taking bids for the erection of a local power plant for service at its works. The plant and electric system are estimated to cost about $400,000.

Newark, N. J. — The New York Telephone Co. has removed its main plant in this city from the building at Washington street and Branford place, occupied for many years, to a new structure at Morris and South Orange avenues.

Newark, N. J. — Alfred Sommer, 466 Summer avenue, has submitted a low bid of $10,753 to the board of education for electrical work in the addition to the Alexander public school. A bid of $33,333 was submitted by the F. & W. V. Engelberger Co., 159 Jelliff avenue, for the heating and ventilating installation.

Newark, N. J.—The Public Service Electric Co. has made application to the State Board of Public Utility Commissioners for permission to issue additional capital stock to the amount of $3,000,000. The proceeds will be used for additions to equipment and new transmission lines, as well as distributing lines, and to reimburse the company for extensions to its plants prior to the first of the present year.

Orange N. J.—The Radium Luminous National Corp., Alden street, has filed plans for the erection of a one-story extension.

Allentown, Pa.—The Allentown Cable & Machine Co., is planning for the erection of a one-story plant, 50 by 100 ft., at Hamilton and John streets, to cost about $35,000.

Altoona, Pa. — The Penn Central Power Co. is planning for the construction of a new transmission line in the vicinity of Twin Rocks, Pa. Day & Zimmerman, Inc., 611 Chestnut street, Philadelphia, is the engineer on the project.

Elwood City, Pa. — The American Steel Co., Park building, will build a one-story power plant, 38 by 60 ft., at its works at Elwood City.

Harrisburg, Pa. — The Harrisburg Light & Power Co. is arranging for the installation of heating mains in Second and Walnut streets. It is proposed to have the new underground lines ready for service in September. The Second street line will extend from Locust to Briggs streets, and the Walnut street main from Fourth street to the Pennsylvania railroad.

Macungie, Pa. — The Lehigh Knitting Mills will build a one-story addition to its boiler plant for increased capacity.

Philadelphia, Pa. — The Bell Telephone Co. has completed plans for the erection of a four-story addition to its exchange plant at Broad and Rockland streets, to cost about $400,000, including equipment.

Philadelphia, Pa.—John Friedrich has had plans prepared for the erection of a one-story power house on North Lawrence street, near Pike street, to be used in connection with his factory at this location.

Philadelphia, Pa.—The Bloch Go-Cart Co., 1134-36 North American street, is taking bids for the erection of a one-story power house at its plant.

Philadelphia, Pa. — The police department is considering the installation of a series of wireless stations throughout the city. Sending and recording apparatus will be installed at important locations. It is estimated that there are about 600 privately owned wireless stations now established in the city.

Philadelphia, Pa.—The H. S. B. W. Cochrane Corp., formerly known as the Harrison Safety Boiler Works, has acquired a plant consisting of a group of factory buildings at 3120 North Seventeenth street. The structures include machine shops, foundry and offices, and were secured for a consideration said to be $158,000. The plant will be used by the new owner in connection with the manufacture of its standard power plant equipment and specialties.

Baltimore, Md.—The Consolidated Gas, Electric Light & Power Co. is considering the extension of its system in the Brooklyn, Curtis Bay and New Annex districts. The city council has reported favorably on the proposed work.

Baltimore, Md. — The Steinmetz Electric Motor Car Corp., recently organized with capital stock of $2,000,000, has acquired property held by Reus Brothers at Kate avenue and the Western Maryland railroad, Arlington, to be used as a site for its plant. It is planned to inaugurate immediate operations, securing necessary machinery and equipment for production. The company will specialize in the manufacture of electrically operated industrial trucks and delivery cars. Charles P. Steinmetz, Schenectady, N. Y., chief engineer for the General Electric Co., heads the new organization.

Baltimore, Md.—The Consolidated Gas. Electric Light & Power Co. has completed plans for the erection of a new purifier works in the Westport district to cost about $40,000. It is proposed to commence immediate construction.

Baltimore, Md.—The DeLion Tire & Rubber Co., 131 Mount Royal avenue, will take bids about July 1 for a new factory. A power plant for works service will be erected, and bids will be asked at the same time. The entire project is estimated to cost about $150,000. J. Osborn Hunt, 114 North Montgomery street, Trenton, N. J., is the architect on the project.

Lewes, Del. — The Navy Department, Washington, D. C., has completed plans for the erection of a new local radio compass station, to be situated on the old artillery grounds, in the vicinity of Lewes Beach. The present station of the government in this vicinity will be abandoned. The new radio plant will be known as the Fourth District Naval Radio Station.

Petersburg, Va. — The Chesterfield Manufacturing Co. has awarded a contract to the Ambursen Construction Co., 186 Fifth avenue, New York City, for the erection of its hydroelectric power plant, to be used in connection with its local cotton mills. The structure will be located on Swift creek.

Grafton, W. Va.—Referee in Bankruptcy O. E. Wyckoff is planning for the early sale of the plant and property of the Grafton Traction Co. About 24 months ago the property was appraised at $232,634, without valuation of franchise.

Columbia, S. C. — The Columbia Railway, Gas & Electric Co. is planning for the erection of an addition to its electric generating plant to cost about $400,000, including the installation of new hydroelectric equipment.

Paris Island, S. C.—The Bureau of Yards & Docks, Washington, D. C., is planning for extensions in the local power plant of the Navy Department, including the installation of considerable new equipment. The installation will include coal-handling equipment, with steel hopper, coal crusher, elevator, etc.; stokers for four 300-hp. boilers; track scales for coal; dump cars, etc., while in the electrical department a new 300-kva. turboalternator will be installed, with exciter, boiler feed pumps and other apparatus.

Union, S. C.—The common council is planning for extensions in the local electric lighting system. It is proposed to issue bonds for $30,000 to cover the cost of the work.

Adel, Ga.—The common council is planning for extensions and improvements in the local electric lighting plant and waterworks, operated in connection, to cost about $12,000.

Eastman, Ga.—The city council has preliminary plans under way for the establishment of a municipal electric light and power plant, with local distributing system.

NORTH CENTRAL STATES.

Cincinnati, O.—The American Can Co., 120 Broadway, New York City, is completing plans for the construction of a four-story reinforced concrete plant at Spring Grove avenue and Fergus street. The plant will cost about $1,000,000, including equipment.

Cincinnati, O. — The Oakley Machine Tool Co. has increased its capital stock from $110,000 to $250,000 and is having plans prepared for a new factory in the Oakley section of Cincinnati.

Cleveland, O.—The Chain Products Co. has increased its capital stock from $250,000 to $450,000.

Cleveland, O. — The Automobile Machinery Co., recently organized for the manufacture of automobile parts, is in the market for new equipment.

Columbus, O.—The Linworth Mutual Light & Power Co. will construct a high-tension line from Worthington to Dublin, O.

Defiance, O.—The Holgate Light & Power Co. has increased its capital stock to $80,000 and has taken over the lines of the Ridgeville Light & Power Co., the McClure Light & Power Co., and the Hamler Light & Power Co.

Delaware, O.—The city council has appointed a committee to consider the advisability of building a municipal electric light and power plant.

Elyria, O.—The Elyria Steel Products Co. has increased its capital stock from $150,000 to $300,000, and is adding a power plant to its plant.

Lodi, O.—D. A. Aken and Howard Brannader have purchased the electric light and power plant and will make radical changes in its operation. Energy will be purchased from the Southwestern company and a rotary converter will be installed to convert the 25-cycle into 60-cycle. The entire system will be rebuilt and the plant will be remodeled.

Mansfield, O.—The Mansfield Sheet & Tin Plate Co. is installing four 6-ton spout hoist jib cranes, with motor-driven hoists.

Spencer, O. — The Spencer Metal Products Co. will build a one-story addition, 40 by 180 ft., to its plant.

Springfield, O. — The Springfield Malleable Iron Co. will build two two-story additions, 30 by 50 ft., to its plant on Bechel avenue, to cost about $55,000.

Anderson, Ind. — The city council has passed an ordinance appropriating $350,000 for the enlargement of the municipal electric light and power plant.

Franklin, Ind.—The Franklin Manufacturing Co. has increased its capital stock from $25,000 to $125,000.

Gary, Ind. — The National Spring Products Co. is building a one-story addition, 93 by 244 ft. to its plant. The addition will cost $60,000.

Seymour, Ind.—Construction work on a post-lighting system on 11 blocks in the business district has been commenced. The system will cost $10,000, bonds having been issued for the payment of the work.

Detroit, Mich. — The International Metal Stamping Co., Muster and Artillery avenues, is taking bids for the construction of a three-story addition, 78 by 530 ft., to its plant.

Durand, Mich.—The village will expend about $40,000 for improvements in the municipal electric light and water plant.

Grand Rapids, Mich. — The Grand Rapids Wire Products Co. has increased its capital stock from $10,000 to $20,000.

Grand Rapids, Mich.—Construction of buildings on a 62-acre site will begin soon by the General Motors Corp. Two units for the manufacture of iceless refrigerators will be erected.

Jackson, Mich.—The Frost Gear & Forge Co. has awarded a contract to the Austin Co., Chicago, for the erection of two one-story additions, 50 by 160 ft., and 40 by 100 ft., to its plant. The estimated cost is about $80,000.

Chicago, Ill.—The Interstate Brass Co., 11 South Desplaines street, is constructing a one-story plant at 15 North Peoria street.

Chicago, Ill.—The Chicago Steel & Wire Co. is taking bids for additions, 70 by 110 ft., and 38 by 64 ft., to its plant, the improvement to cost about $100,000, including equipment. L. G. Hallberg & Co., 116 South Michigan avenue, is the architect on the project.

Litchfield, Ill.—The city council is planning the establishment of a "white way" system of lighting on the business streets.

Milwaukee, Wis. — The American Metal Products Co. has increased its capital stock from $100,000 to $300,000 and will build a machine shop, 75 by 150 ft., and a foundry, 50 by 75 ft., to cost about $100,000.

Oskaloosa, Ia. — The Oskaloosa Home Telephone Co. is planning improvements to its property to cost about $40,000. George Gordon is the general manager of the company.

St. Joseph, Mo. — The St. Joseph Heat, Light & Railway Co. is planning for enlargements in its electric power plant, including the installation of new equipment.

Wheaton, Mo.—The Wheaton Milling & Power Co. is in the market for electric motors and other equipment. H. G. Goosetree is the manager of the company.

Americus, Kans.—An issue of electric light bonds to the amount of $10,000 was voted by the citizens at a recent election.

Campbell, Neb.—A special election will be held in the near future to vote on the issuance of $10,000 in bonds for the improvement of the electric lighting system.

SOUTH CENTRAL STATES.

Memphis, Tenn. — The Memphis Iron & Steel Co. is having plans prepared for a plant to cost about $300,000 with equipment.

Birmingham, Ala. — The Alabama Power Co. is considering plans for additions to its hydroelectric power plants and system. It is proposed to build a new works on the Tallapoosa river with initial capacity of about 90,000 hp.

Birmingham, Ala.—The Tennessee Coal, Iron & Railroad Co. contemplates the erection of a power plant estimated to cost between $2,000,000 and $3,000,000.

Laurel City, Miss.—The city council has arranged for a bond issue of $50,000 for the erection of a municipal light and power plant, and waterworks system.

Houston, Tex.—The city council is considering plans for a new power plant to cost about $60,000.

Mercedes, Tex.—The Llano Grande Plantation Co., Scanlon building, Houston, Tex., is planning for the establishment of a local power plant, with a transmission system throughout this section. The line will be operated at 2300 volts. Construction work on the plant will be inaugurated at once.

WESTERN STATES.

Brigham City, Utah—Finding that it will cost $120,000 to rebuild the municipal electric light plant and thus develop the maximum electrical energy on Box Elder creek the city has decided to erect a large modern generating plant, equip it with the latest machinery and abandon or sell the present plant.

Portland, Ore.—An electric line station will be constructed here for the Southern Pacific Co. J. H. Christie, San Francisco, Cal., is the architect on the project.

Los Angeles, Cal.—The new plant of the Oil Mining Equipment Co., 2026 Santa Fe avenue, will consist of a main building, 80 by 550 ft., with a wing, 60 by 150 ft.; a one-story shop, 20 by 200 ft.; boiler plant, 16 by 16 ft., and tank department, 20 by 20 ft. Gordon LaBarr, 500 Stimson building is the architect on the project.

Los Angeles, Cal. — The Hopper Welding Works, 1046 South Olive street has been organized to manufacture welding apparatus. Charles Hopper heads the new company.

Redding, Cal.—The Pacific Gas & Electric Co. will erect two power stations in Hot Creek valley, each developing 10,000 hp.

San Francisco, Cal. — The Lassen Electric Co. has been authorized by the California Railroad Commission to issue bonds for $100,000 to build 25 mi. of transmission lines.

Stockton, Cal. — Considerable electrical and mechanical machinery will be installed in the addition to be erected at the plant of the National Paper Products Co. The addition will be two-story, 180 by 655 ft., of brick and steel construction, and is estimated to cost $1,000,000.

CANADA.

Calgary, Alta. — Construction work on the proposed central heating and lighting plant, costing from $750,000 to $1,000,000, may be commenced this summer. R. H. Scott is behind the project.

Coburg, Ont.—The Langslow-Fowler Furniture Co., Rochester, N. Y., has started work on the erection of a factory to cost $200,000, including equipment.

Galt, Ont. — The Wells Brothers Co., of Canada, Ltd., will change its name to the Greenfield Tap & Die Corp. of Canada, Ltd., and will increase its capital stock from $40,000 to $250,000.

Newmarket, Ont. — Fire recently destroyed the municipal electric light and water plant at a loss of $10,000.

INCORPORATIONS.

Toledo, O. — The Cousino Spot Light Device Co. has been incorporated with capital stock of $100,000. W. N. Hoot, W. C. Dunn and others are the incorporators.

Los Angeles, Cal. — The Staweld Welding Corp. has been incorporated with capital stock of $100,000 to manufacture welding apparatus. Charles T. Kennedy and others are the incorporators.

Allentown, Pa. — The Allentown Storage Battery Co. Capital stock, $10,000. To manufacture electric storage batteries, etc. George D. Fisher is the principal incorporator.

Los Angeles, Cal. — The Vulcan Electric Co. has been incorporated with capital stock of $200,000 to manufacture electrical specialties. W. W. Sweeney, I. W. Gleason and H. A. Masac are the incorporators.

Brooklyn, N. Y.—The Delta Electric Co. Capital stock, $6000. To manufacture electrical specialties, and engage in contracting. Incorporators: C. Michaels, G. Jalens and M. Reichstein, 145 South Fourth street.

Tonawanda, N. Y.—The Wallenberg Sales Co. Capital stock, $100,000. To manufacture motors, engines and other electrical products. Incorporators: L. J. Tieber, H. E. Korff and F. J. Wallenberg, Tonawanda.

Newark, N. J.—The Electric Box & Covering Co. Capital stock, $125,000. To manufacture electric switches, boxes and kindred specialties. Incorporators: Emanuel Shaw, W. L. Greenbaum and Jacob Lubetkin, all of Newark.

Dallas, Tex.—The Dallas Elevator & Electric Co. Capital stock, $35,000. To manufacture electric elevators, parts, etc. Incorporators: W. O. Parker, A. C. Bookout and E. B. Thomas.

Baltimore, Md.—The International Telephone & Telegraph Co. Capital, $25,000,000. To install and operate telephone and telegraph systems in the West Indies, Mexico, Central America and South America. Incorporators: J. Howard Auchincloss, Fitz-John Porter and Otis Treat Bradley, 50 Vanderbilt avenue, New York.

Why Do We Advertise When We Are Behind in Deliveries?

THIS seems to be a very natural question, and the answer involves the discussion of a vital policy of this business—a policy that is fundamental.

If we were building a business for today our policy would vary from day to day with the temporary changes with which every business has to contend.

But we are building for the time to come and we hope that this business will become many times greater than it is today. Without the proper foundation it would undergo violent changes dependent upon temporary national, local or even imaginary conditions.

If we should permit ourselves to become inflated with self-confidence when business conditions are favorable, restricting our selling and advertising activities, and go down in the dumps when conditions are not so favorable, this business would not amount to any more than the existing conditions would make of it.

We say right now, without reservations, that we hope, *regardless of how aggressive and efficient our manufacturing department may be, that it will never be able to catch up with our selling organization.*

If our efforts should be halted in the middle of the road in times of liberal buying to wait on the manufacturing department, there might come a time when the manufacturing department would have to suspend operations while waiting on the sales organization.

With such a policy we would be running around in a circle, disorganizing one day and reorganizing the next.

The greater the demand for our product, the quicker the turnover for merchants; and the more frequent the turnovers, the larger is the volume of profit.

In this business advertising is a sales policy—the same as our policy of maintaining a sales organization—and we might as well consider the elimination of one as the other. Neither will be eliminated, as this business needs both if we are building for the future.

We hope the idea will never creep into this organization that there will be any let-up in aggressive methods, which might suggest that when business is good there is no occasion for work and when business is poor it is too hard to get.

We constantly have in mind that the American *people are much more concerned in their own affairs than in ours, and if we should restrict our selling and advertising activities they will begin to forget us—and this would be our fault.*

We are going ahead with the idea of increasing the present momentum in favor of our goods; and if conditions should turn face about, our dealers and ourselves will be in a better position to hurdle obstacles than if we originated a policy for each condition as it arose.

The foregoing is taken from *Graphite*, the magazine of the Joseph Dixon Crucible Co., Jersey City, N. J.

As this company has been in business since 1827, and is still the strongest in that line of business to-day, it would seem that many others might profit by sound advice given.

C. A. TUPPER, PRESIDENT,
INTERNATIONAL TRADE PRESS, INC.,
CHICAGO.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Southern Bell Telephone & Telegraph Bonds Sell High.

The Southern Bell Telephone & Telegraph Co. first mortgage sinking fund 5% bonds, due Jan. 1, 1941, currently selling at 78½ to yield 6.99%, are at their2lowest price on record, compared with a high of 85½ this year and a record high price of 102¼ in 1916. The $16,802,000 outstanding are issued in denominations of $1,000 and $500 and are redeemable as a whole only at 105. These bonds are a direct obligation, secured by a first mortgage on the entire property, franchises, stocks and other securities.

Dividends.

The American Gas & Electric Co. has declared an extra dividend of 2% on its common stock, payable in the common stock of the company, and has also declared its regular quarterly dividend of 1¾% on the preferred stock. The common stock dividend is payable June 1 to stockholders of record June 18 and the preferred dividend is payable Aug. 2 to stockholders of record July 15.

Republic Railway & Light Co. Defers Dividends.

At a recent meeting of the directors of the Republic Railway & Light Co. no action was taken on the regular quarterly dividend of 1½% on the preferred stock. Although the earnings of the company for the last quarter have shown substantial increases over the corresponding period of last year, the directors felt that in view of pending financing the cash resources of the company should be conserved and used for necessary construction.

Northern Texas Electric Co.

	1920.	1919.
April gross .....$	310,205	$ 259,595
Net earnings	118,162	104,723
Surplus after charges	93,300	79,878
Twelve months 'gross	3,624,725	2,886,615
Net earnings	1,421,762	1,090,365
Surplus after charges	1,123,044	789,517

Reading Transit & Light System.

	1920.	1919.
April gross .....$	243,167	$ 201,618
Net after taxes	23,713	34,810

Southwestern Power & Light Co. Subsidiaries.

	1920.	1919.
April gross .....$	698,927	$ 481,330
Net earnings	288,837	164,337
Twelve months' gross	7,278,107	5,925,508
Net earnings	2,891,165	2,116,535

Southern Utilities Co.

	1920.	1919.
April gross .....$	231,404	$ 149,002
Net after taxes	422,392	89,122
Total income	424,750	89,122
Surplus after charges	221,315	*69,619
Twelve months' gross	2,230,444	1,616,251
Net after taxes	38,718	17,091
Total income	38,952	17,091
Surplus after charges	22,124	2,531

*Deficit.

Cumberland County Power & Light Co.

	1920.	1919.
April gross .....$	239,901	$ 203,517
Net earnings	79,803	52,659
Surplus after charges	23,793	*3,505
Twelve months' gross	2,888,196	3,114,017
Net earnings	973,290	954,897
Surplus after charges	304,355	156,456
Balance after preferred dividends	166,355	18,456

*Deficit.

Blackstone Valley Gas & Electric Co.

	1920.	1919.
April gross .....$	265,928	$ 191,619
Net earnings	87,456	55,408
Surplus after charges	62,581	30,800
Twelve months' gross	2,596,937	2,531,917
Net earnings	879,527	671,213
Surplus after charges	581,330	382,893

Keystone Telephone Co.

	1920.	1919.
May gross .....$	144,353	$ 134,297
Net after taxes	51,507	42,855
Surplus after interest charges	16,169	13,793
Five months' gross ..	717,821	654,197
Net after taxes	256,561	216,518
Surplus after interest charges	78,785	70,746

Tennessee Power Co.

	1920.	1919.
April gross .....$	196,922	$ 179,066
Net after taxes	82,110	64,051
Surplus after interest charges	29,262	10,251
Twelve months' gross	2,125,360	2,402,953
Net after taxes	842,365	955,493
Surplus after interest charges	197,334	318,130

The Muskogee (Okla.) Gas & Electric Co. has declared its regular quarterly dividend of 1¾% on its preferred stock, payable June 15 to stockholders of record May 29.

Great Western Power System.

	1920.	1919.
April gross .....$	460,104	$ 412,598
Net after taxes	246,144	251,229
Surplus after charges	47,658	79,874
Twelve months' gross	5,588,530	4,965,796
Net after taxes	3,086,410	2,933,946
Surplus after charges	799,428	934,158

Tennessee Railway, Light & Power Co. Earnings Increase.

The combined earnings of the Tennessee Railway, Light & Power Co., the Nashville Railway & Light Co., the Tennessee Power Co., and the Chattanooga Railway & Light Co., for April, 1920, and the twelve months preceding follow:

	1920.	1919.
April gross .....$	544,139	$ 459,251
Net after taxes	197,448	167,870
Twelve months' gross	5,762,085	5,688,499
Net after taxes	2,062,757	2,300,527

East St. Louis & Suburban System.

	1920.	1919.
April gross .....$	300,067	$ 247,524
Net after taxes	58,659	40,348
Surplus after charges	4,169	*16,770
Twelve months' gross	3,483,294	3,322,600
Net after taxes	797,847	794,762
Surplus after charges	136,947	138,363

*Deficit.

Galveston-Houston Electric Co.

	1920.	1919.
April gross .....$	299,825	$ 247,481
Net earnings	88,777	69,027
Surplus after charges	53,446	31,001
Twelve months' gross	3,229,703	2,860,162
Net earnings	846,795	815,512
Surplus after charges	424,122	449,107

Binghamton Light, Heat & Power Co.

	1920.	1919.
March gross.....$	49,424	$38,321
Net after taxes.....	12,933	13,384

Northern Texas Electric Co.

	1920.	1919.
March earnings .....$	336,949	$ 277,721
Net earnings	133,999	114,015
Surplus after charges	109,136	88,777

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid June 15.	Bid June 22.
Adirondack Electric Power of Glens Falls, common	..6	10	10
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	105	110
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	135	125
American Light & Traction of New York, preferred	6	80	79
American Power & Light of New York, common	4	50	49
American Power & Light of New York, preferred	6	65	63
American Public Utilities of Grand Rapids, common	..	4	4
American Public Utilities of Grand Rapids, preferred	7	12	12
American Telephone & Telegraph of New York	..	103	102
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	5	8
American Water Works & Elec. of New York, first preferred	..	36	38
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	15	15
Cities Service of New York, common	+extra	325	325
Cities Service of New York, preferred	6	64	64
Commonwealth Edison of Chicago	8	100	101
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	39	38
Federal Light & Traction of New York, common	..	6	7
Federal Light & Traction of New York, preferred	..	41	41
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	33	34
Northern States Power of Chicago, common	..	35	34
Northern States Power of Chicago, preferred	ex.div.7	78	76
Pacific Gas & Electric of San Francisco, common	..	58	60
Public Service of Northern Illinois, Chicago, common	7	76	76
Public Service of Northern Illinois, Chicago, preferred	6	79	79
Standard Gas & Electric of Chicago, common	..	13	13
Standard Gas & Electric of Chicago, preferred	6	35	34
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3	3
United Light & Railways of Grand Rapids, common	4	18	19
United Light & Railways of Grand Rapids, preferred	6	55	57
Western Power of San Francisco, common	..	14	14
Western Union Telegraph of New York	extra	82	82
Industrials—			
Electric Storage Battery of Philadelphia, common	4	103	102
General Electric of Schenectady	8	178	180
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54	54

Electrical Review

Vol. 76. No. 26. CHICAGO, JUNE 26, 1920. Three Dollars a Year

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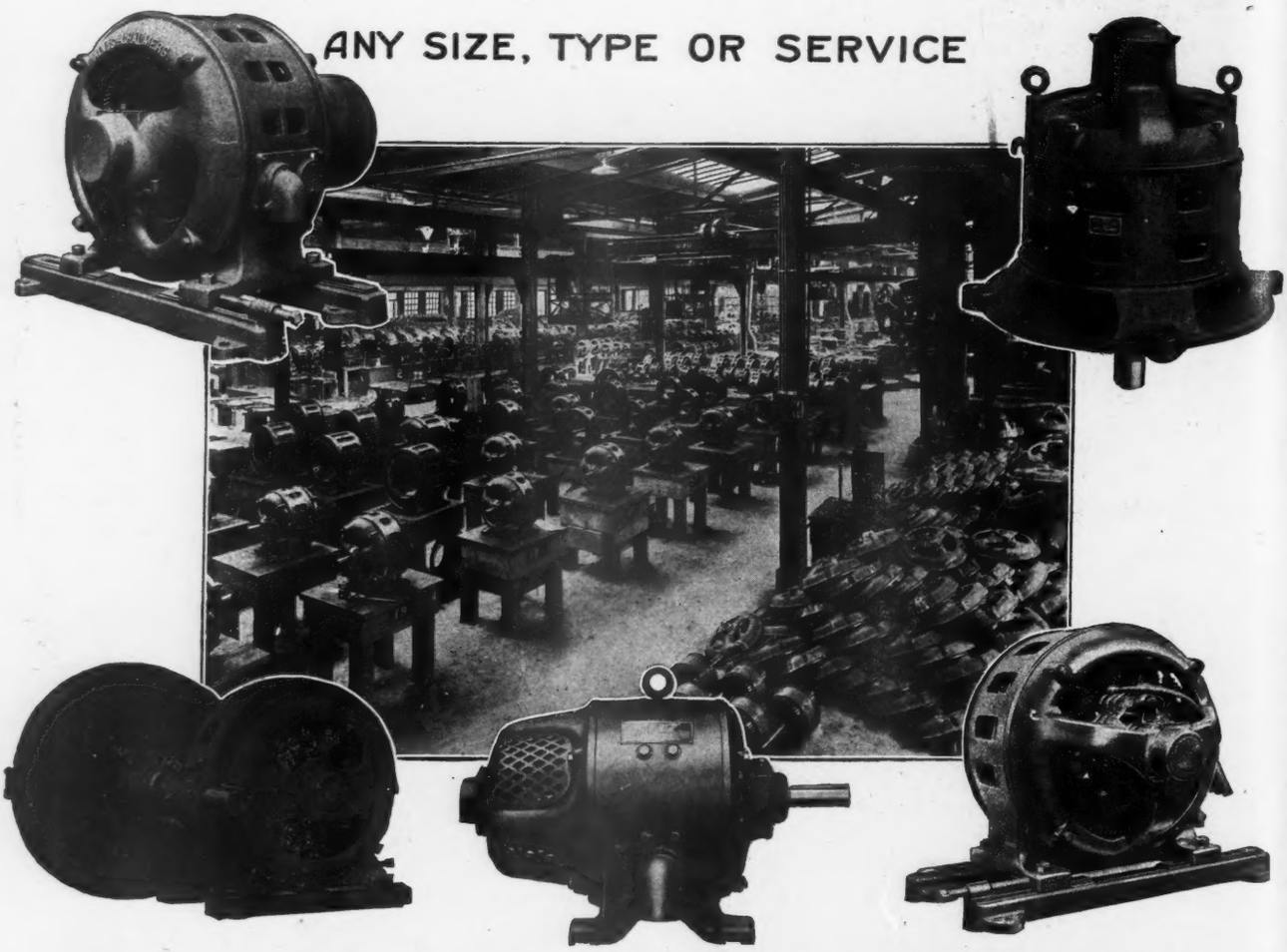

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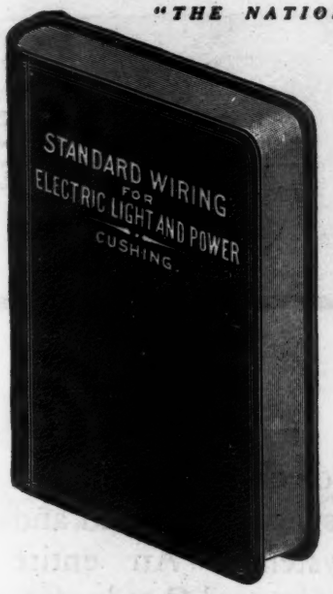

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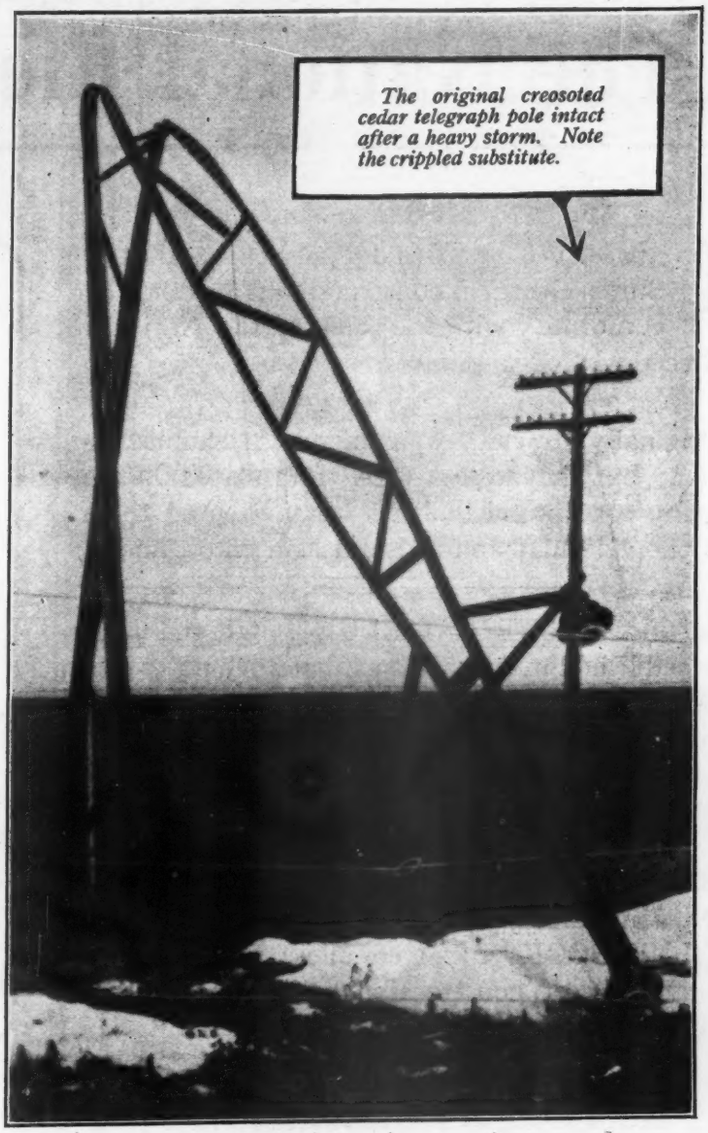

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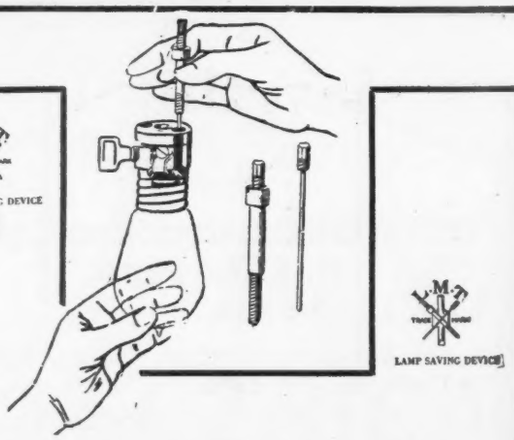

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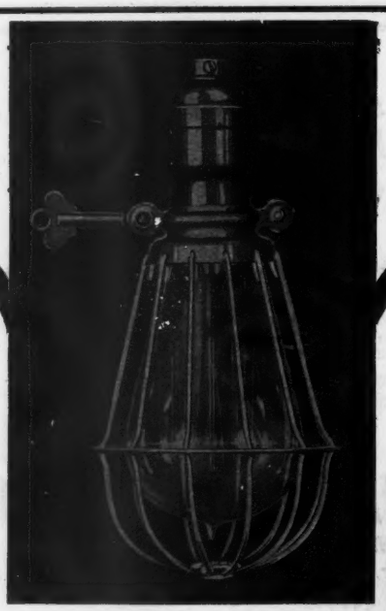

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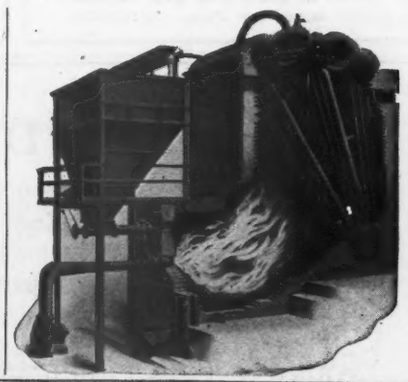

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TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 17, 1920.—Sealed proposals will be opened in this office at 3 p. m., July 15, 1920, for removing old conduit and wiring and lighting fixtures and furnishing and installing new conduit and wiring and new lighting fixtures, etc., in the United States Courthouse and Post Office, Opelousas, La., in accordance with the specification and drawings, copies of which may be had at this office or at the office of the Custodian, Opelousas, La., in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

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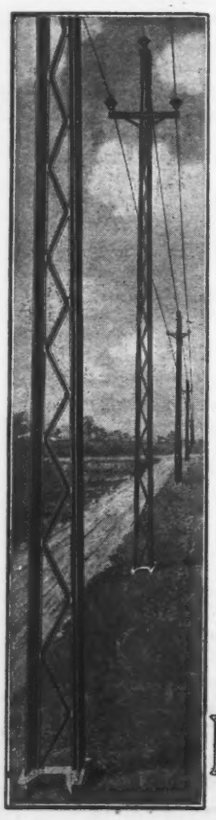

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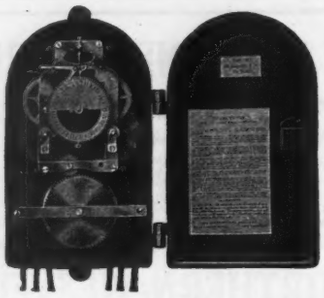

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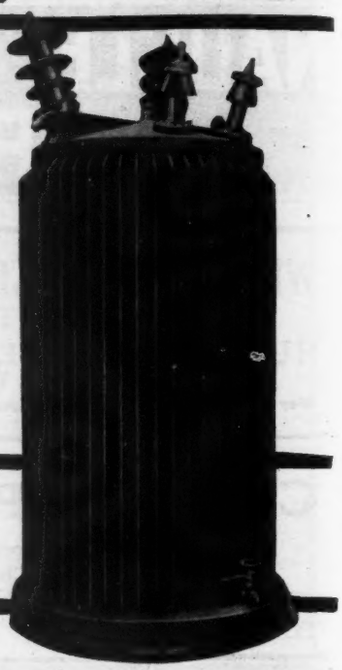

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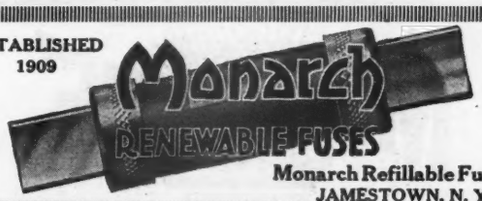

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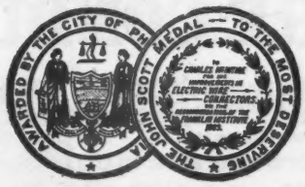

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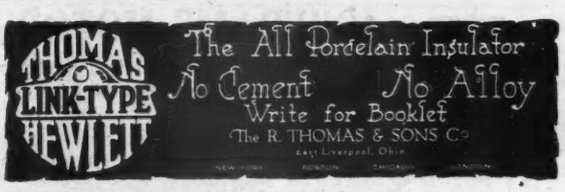

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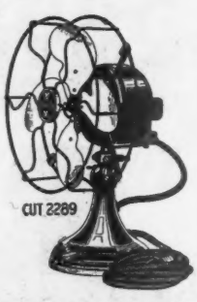

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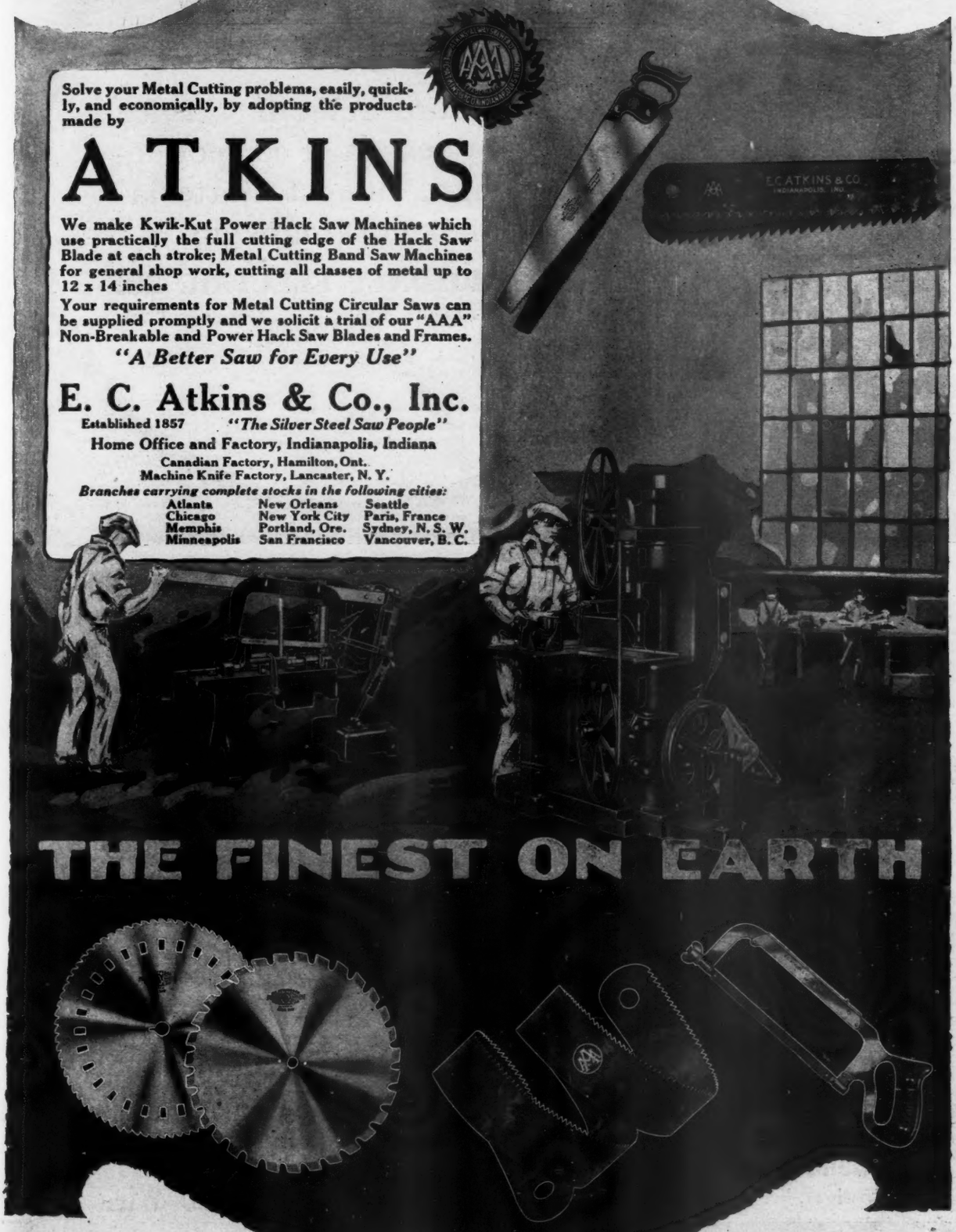

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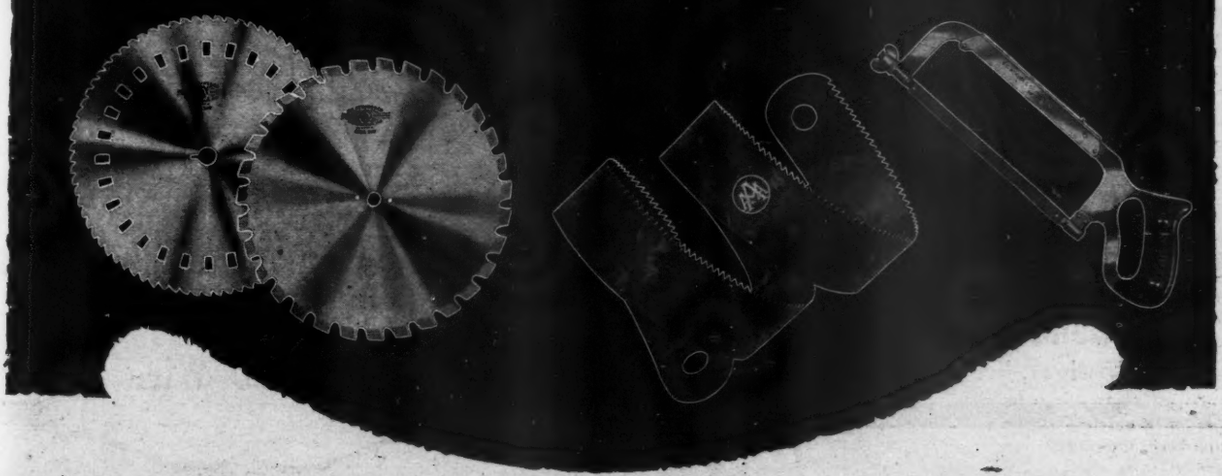

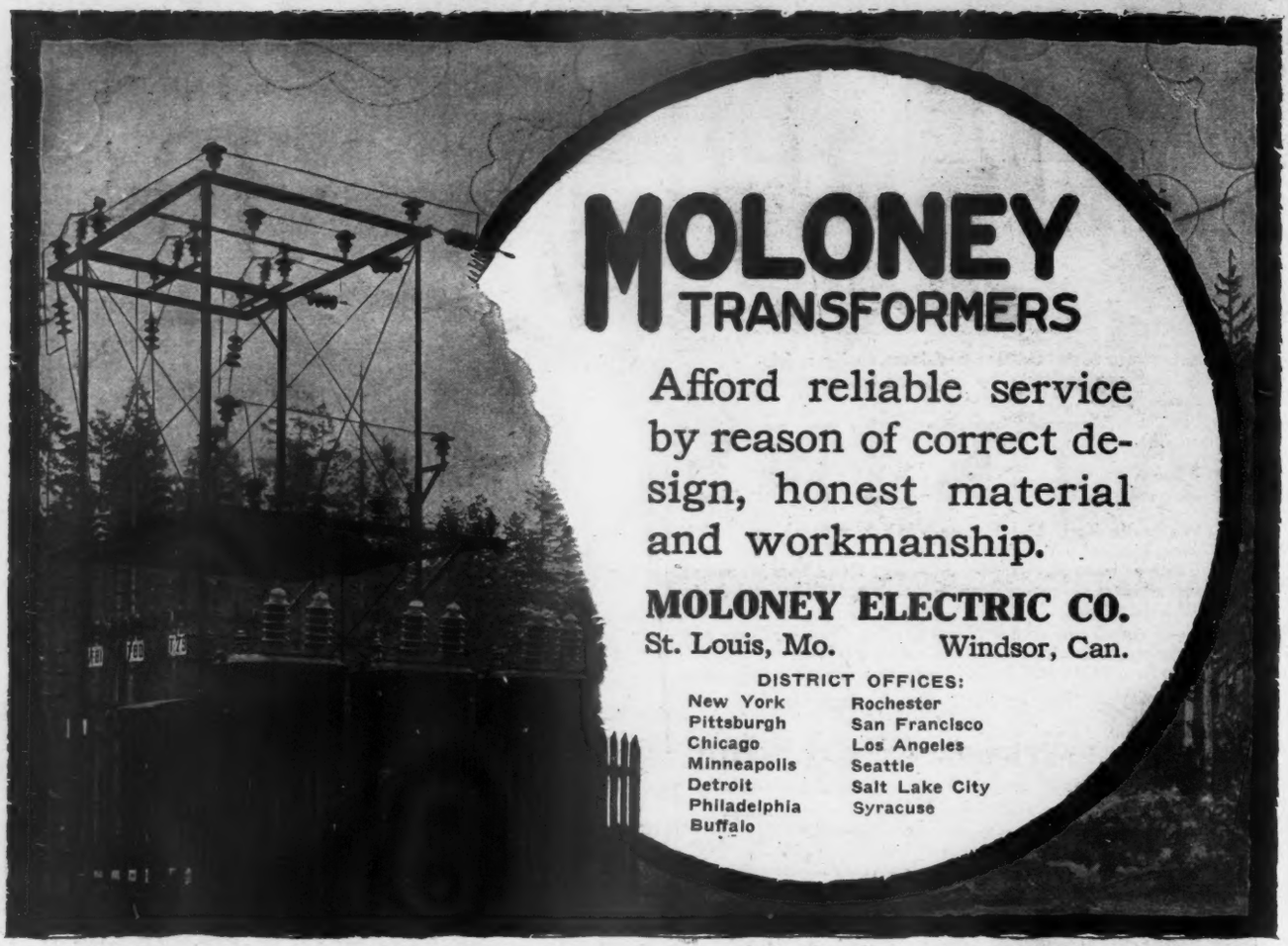

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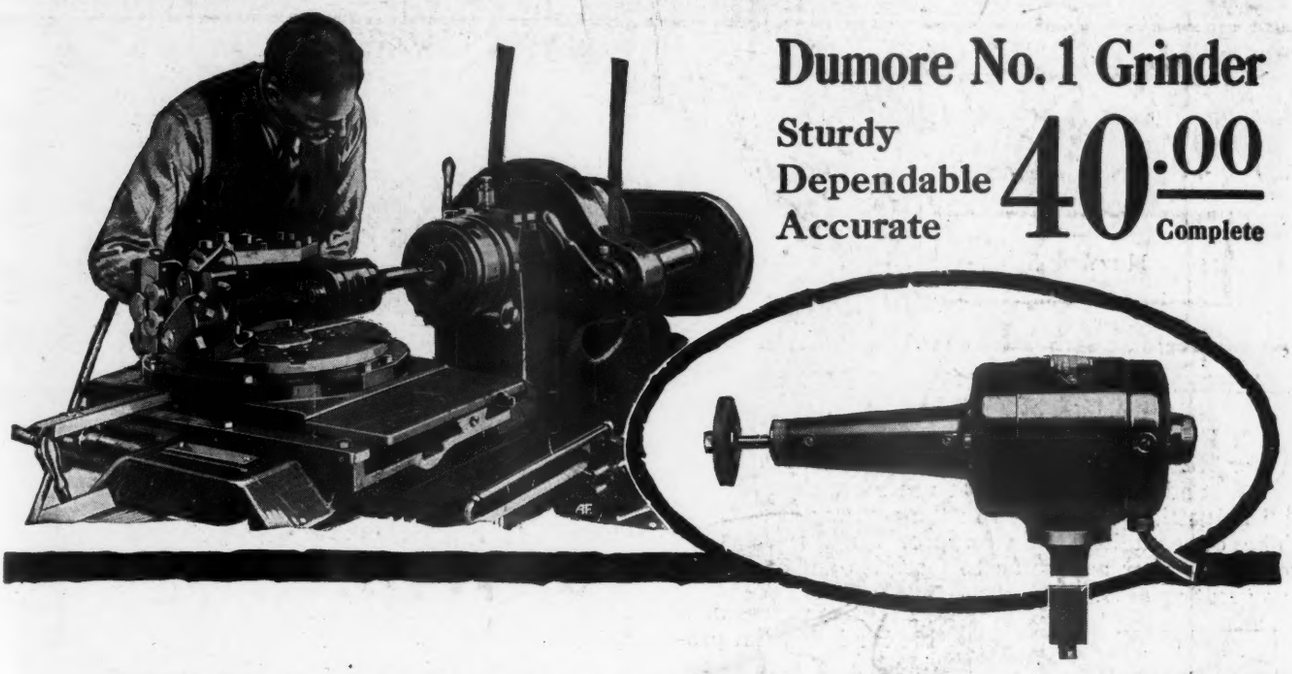

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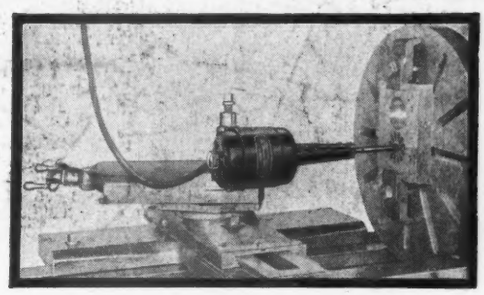
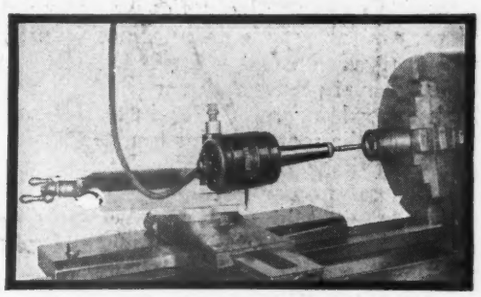
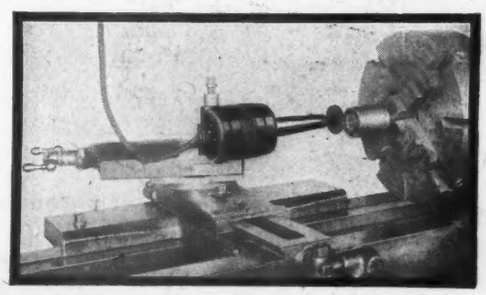
We have some very interesting literature for men facing grinding problems —write for it.







WISCONSIN ELECTRIC COMPANY
5224 SIXTEENTH STREET
RACINE, WIS.

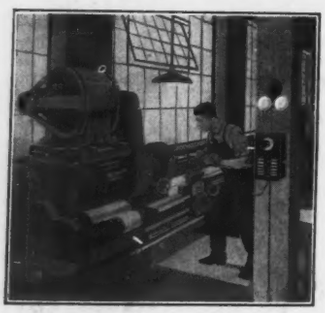
DUMORE HIGH SPEED GRINDERS

Western Electric Items

Number 5 — June 26, 1920

MAKING ELECTRIC ENERGY AVAILABLE WHEREVER NEEDED.

GREAT strides have been made in the application of electric power to all kinds of shop and factory work, yet not more than half of all industrial power used in the country is electric. The opportunities therefore for making sales of electric power apparatus to factories and mills are as great as ever.



Executives responsible for industrial production should have brought to their attention more convincingly, the economic advantages of electric power. It should be demonstrated and proven to them that there is a saving in dollars and cents in having an electric motor at every loom, lathe and machine—wherever power is required.

Western Electric motors cover every power requirement, and are made in all sizes from 1/200 horsepower upwards. They are being used in thousands of industrial plants all over the country and have a high record for reliability in performance.

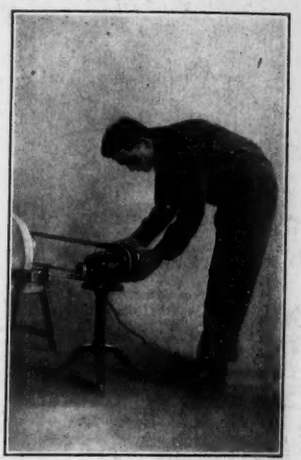
One of the most popular types is the Western Electric Polyphase Induction Motor, which is designed for general power purposes requiring from ½ h.p. upwards at constant speed requiring moderate torque. It is especially suitable for installations where inflammable material is used, owing to its sparkless operation.

No matter what kind of machine you wish to operate, we can supply a motor that will satisfactorily drive it. Illustrated bulletins will be sent on request.

Photo of Woodworking Shop, showing motors used for individual drive of each machine.

PORTABLE POWER

WHEREVER there's a wheel that needs 1/6 horsepower or less to turn it, the Western Electric Utility Motor can be used to excellent advantage.



Western Electric Utility Motor.

It will drive lathes, drills, forge blowers, pumps, grindstones, and other machinery that is used only occasionally and for which a permanent motor is not needed. This motor can be carried right up to the job. The belt is then put on and the plug inserted in the most convenient socket or wall receptable.

Western Electric Utility Motors can be operated at different speeds all the way from high to low. They can be supplied for 110 volt D. C., 110 volt A. C., or 32 volt D. C.

Many sales can be made by demonstrating and explaining to prospects the numerous advantages of the Western Electric Utility Motor.
Write for literature on these motors.

WESTERN ELECTRIC HAMMERS SPEED UP ALTERATION WORK.

THEY will do the work of pneumatic tools of like capacity at about 15% of the power cost, and without the expense and inconvenience of compressor, air piping, hose, etc.

The economy over hand work is from 80% to 90%. A Western Electric Hammer or Drill frequently saves its cost in one week.

Alteration work often requires the cutting of plaster and tile for wiring conduit. By using a special channeling tool, a man can do such work with surprising speed.

A tremendous amount of alteration work is being done throughout the country, which means that the opportunities for making sales of Western Electric Hammers and Drills are exceptionally good at this time.

Write our nearest house for full information.

Western Electric Hammer used for channeling plaster.